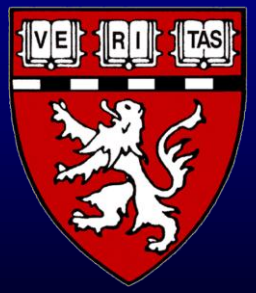
Ultrasound Evaluation of Lumps, Bumps and Small Parts of the Extremities

Michael J. Callahan, M.D.
Department of Radiology
Boston Children's Hospital



No disclosures

Learning Objectives

- Background information
- BCH experiences
- Clinical perspectives

Learning Objectives

- Background information
- BCH experiences
- Clinical perspectives

Pediatric superficial soft tissue masses

- Common
- Variable pathology
- Most can be treated conservatively

Pediatric superficial soft tissue masses

Benign >>> malignant

Pediatric superficial soft tissue masses

- 1% of all pediatric soft tissue tumors are malignant
- up to 25% malignant if small superficial lesions are excluded

Brisse et al. Imaging and Diagnostic Strategy of soft tissue tumors in children Eur Radiol (2006) 16: 1147-1164

Clinical Evaluation

- Radiologist & Sonographer
  - Direct examination & discussion
  - Facilitates accurate report

Clinical Evaluation

- Where?
- Does it hurt?
- Mobile or fixed?
- Skin Changes?
- Systemic Symptoms?

Clinical Evaluation

- Age of patient ?
- Lesion Duration ?
- Congenital ?
- Growth pattern ?

Ultrasound Examination

- Location
  - Anatomic location
  - Depth
- Shape / Margins
- Echotexture / Internal Characteristics
- Vascularity

Ultrasound Examination

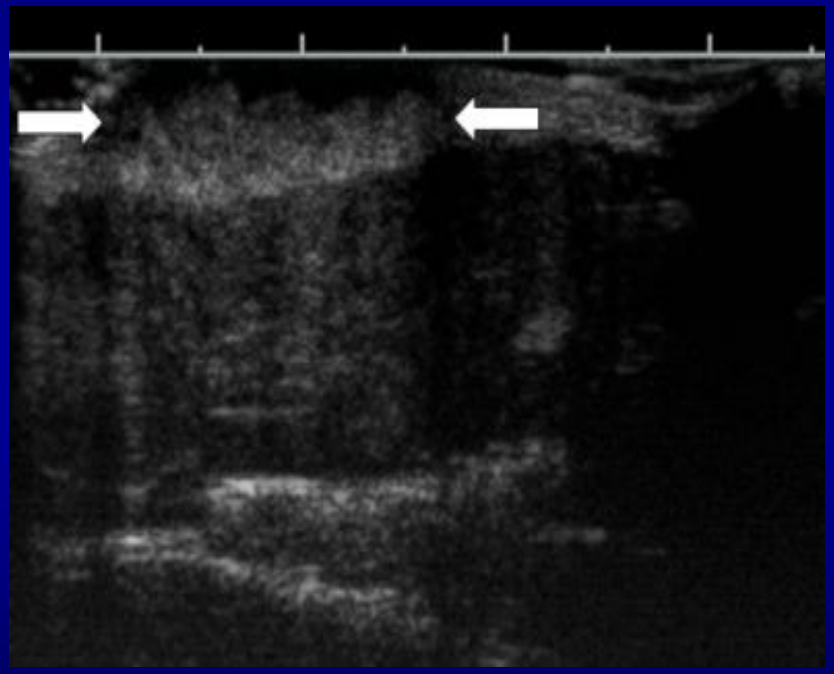
- Comparison views of contralateral side

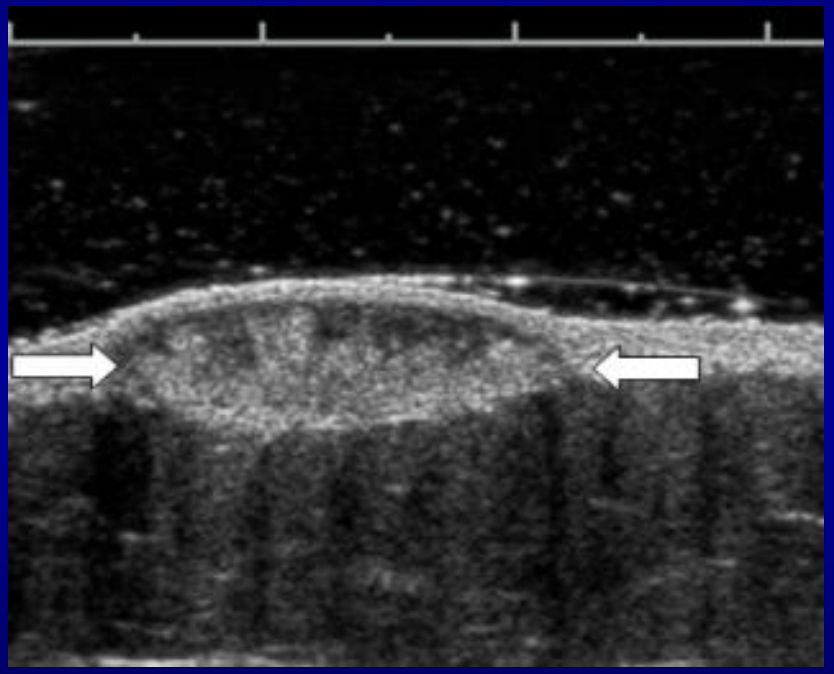
Ultrasound Examination

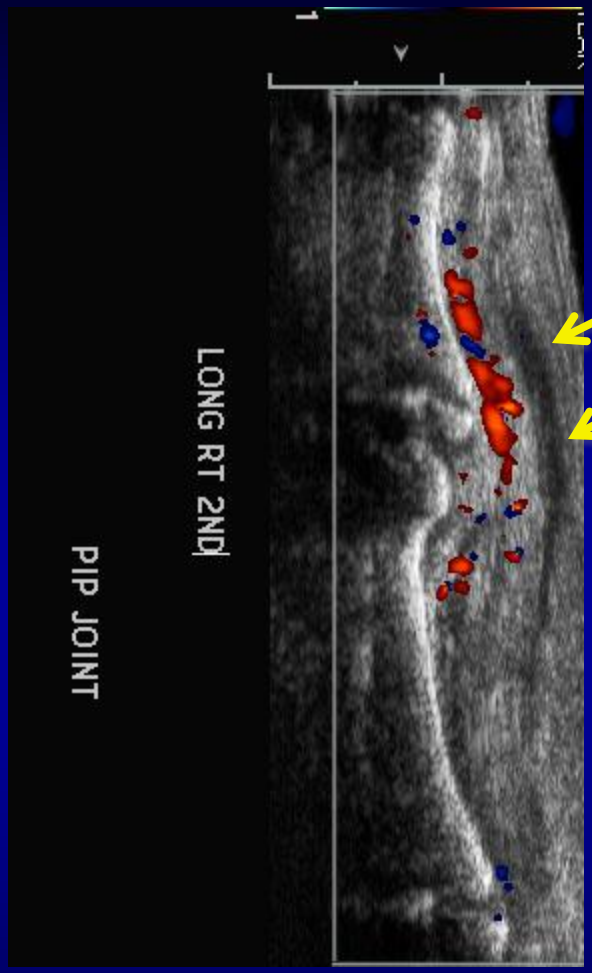
- High frequency Linear Transducer

- Gel
- Standoff Pad
- Waterbath

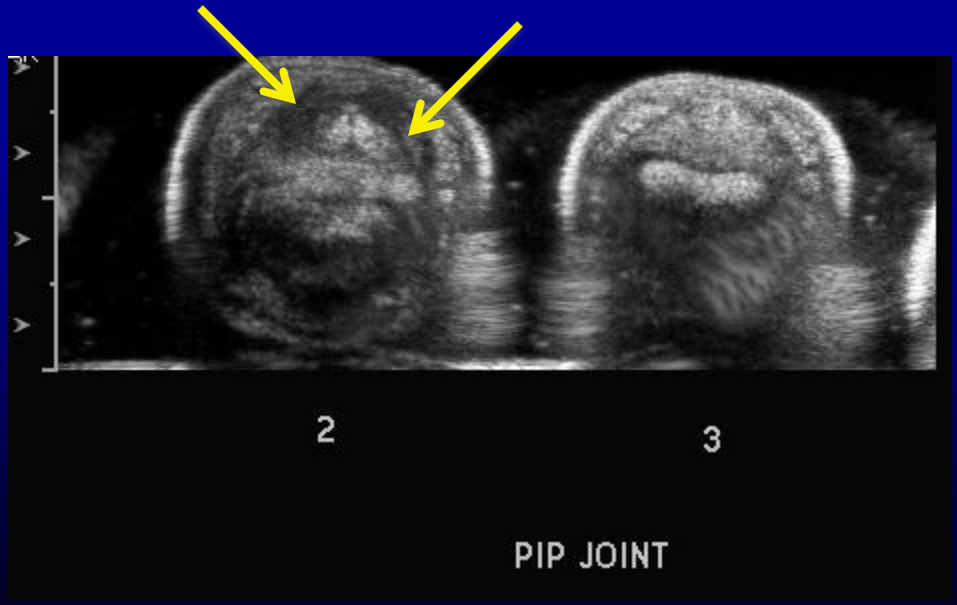
Standoff Pad





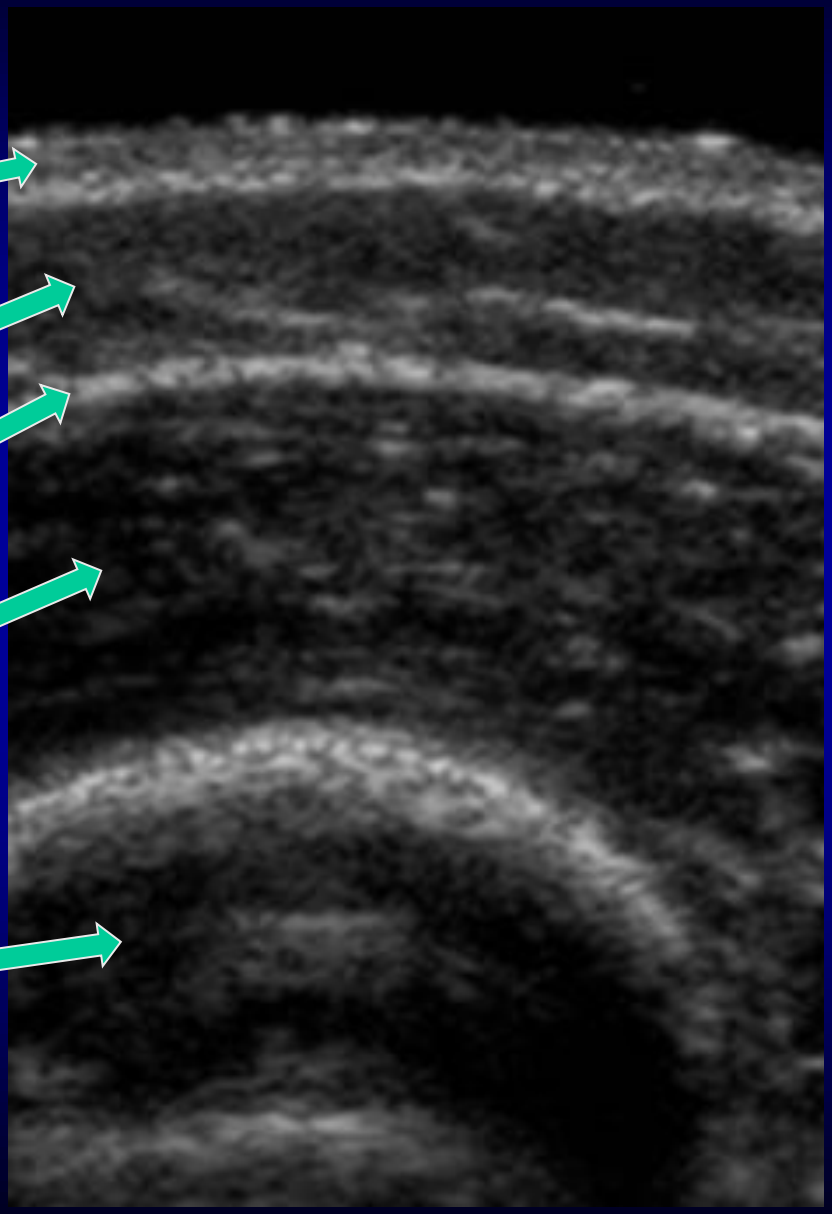


Waterbath



Anatomy

- Dermis
- Subcutaneous tissues
- Fascia
- Muscle
- Bone, Joint



Learning Objectives

- Background information
- **BCH experiences**
- Clinical perspectives

BCH experiences

Ultrasound evaluation of superficial lumps and bumps of the extremities in children: a 5-year retrospective review

Shah S, Callahan MJ. Pediatric Radiology MSK supplement, In press

BCH experiences

- IRB approval
- Extremity US
  - CPT codes 5 - year period (2007-2012)
  - "Mass, lump, bump, nodule"

BCH experiences

- 1052 results from search
  - 754 studies head, neck, torso
  - 298 studies of extremities (272 patients)

BCH experiences

- Male = 131 (48%)
- Female = 141 (52%)

- Mean age = 8.7 years
- Range = 2 wks – 24.8 years

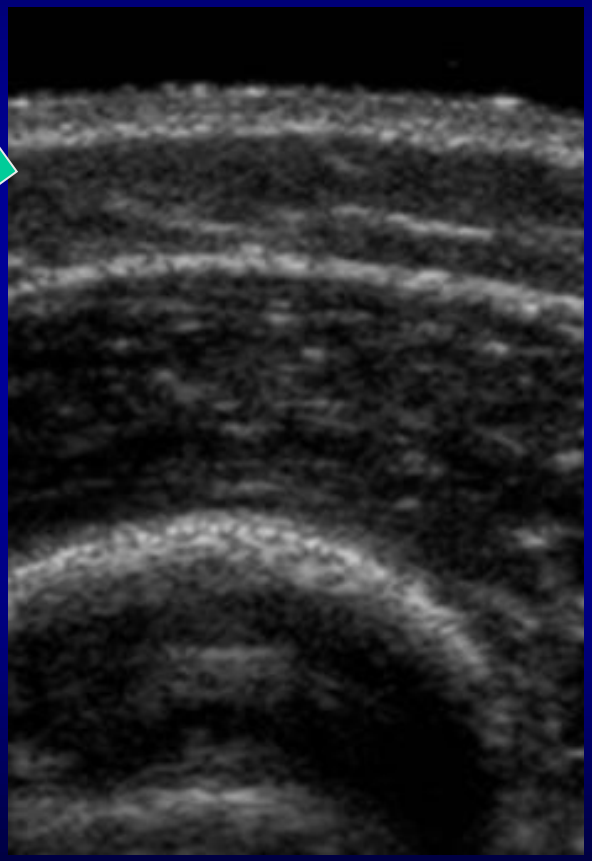
BCH experiences

- Upper extremity = 109 (40%)
- Lower extremity = 163 (60%)

- Mass = 208
- Focal abnormality = 35
- No abnormality = 29

BCH experiences

- SQ = 191
- Deep fascia= 7
- Muscle = 21
- Joint = 3
- SQ w tail to joint = 12
- Bone = 3
- Other (skin, inguinal canal, tendon) = 5



BCH experiences

- 54 (20%) no clinical or imaging follow-up
  - excluded
- Remaining patients
  - Pathologic confirmation
    42 (21%)
  - MRI evaluation 49 (24%)

BCH experiences

- Impression
  - Benign Dx = 142
  - Narrow Ddx (all benign dx) = 19
  - Non – Specific = 27
  - Non – Specific vascular lesion = 5
  - Wide Ddx (including malignancy) = 5
  - Highly concerning for malignancy = 5

BCH experiences

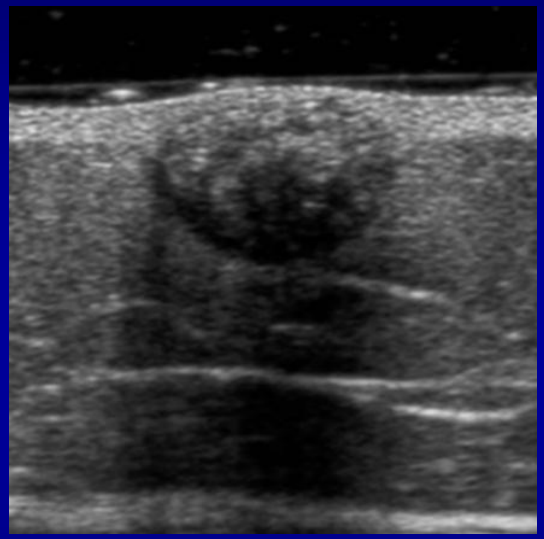
- None of the “benign” diagnoses were found to be malignant
- None of the sonographically “non-specific” lesions were malignant
- Many of our cases had “benign” clinical follow up, but no pathologic or MR diagnoses

10

- Pilomatricoma = 3
- Giant Cell Tumor of the TS = 3
- Foreign Body = 3
- Granuloma Annulare = 3
- Axillary Breast Tissue = 3

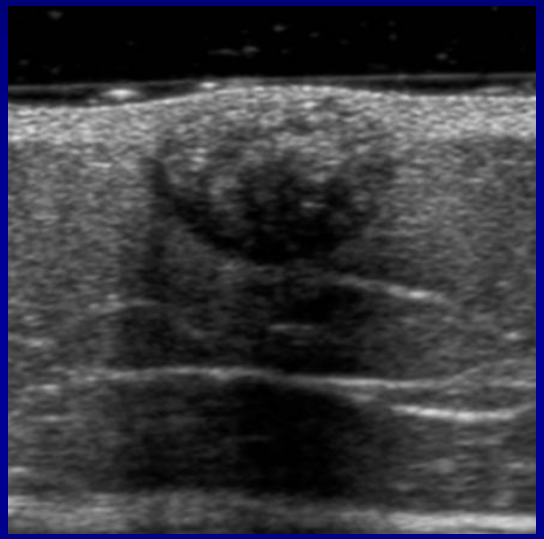
Pilomatricoma

- Benign tumor
- Hair follicle
- < 20 yr
- Head & Neck, upper extremity



Pilomatricoma

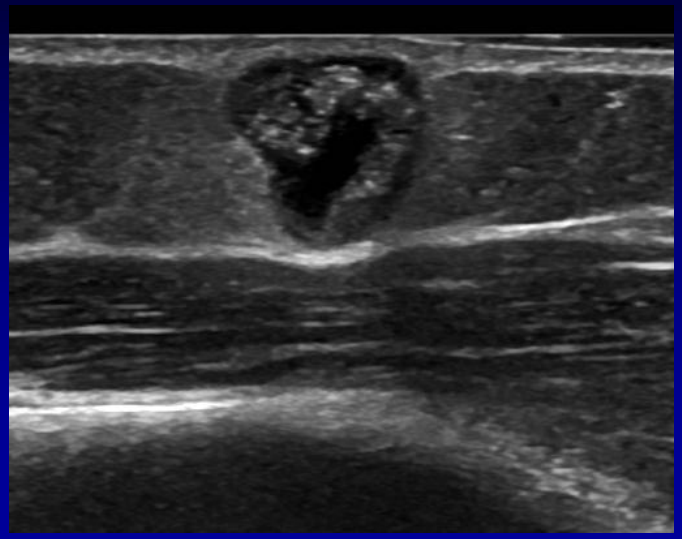
- Firm
- Often dx clinically
- Surgical excision



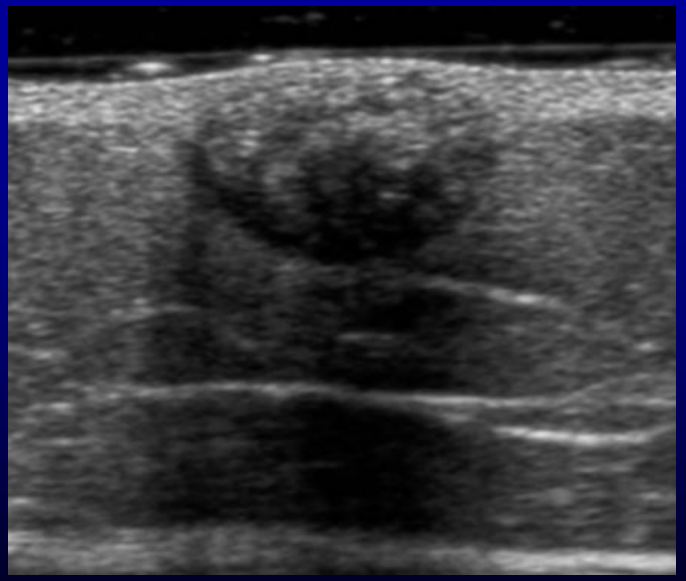
- Dermis, grows into SQ tissues

Pilomatricoma

- Well-defined
- Heterogeneous
- Hypoechoic rim



- Homgeneous hyperechoic
- Ca 2+

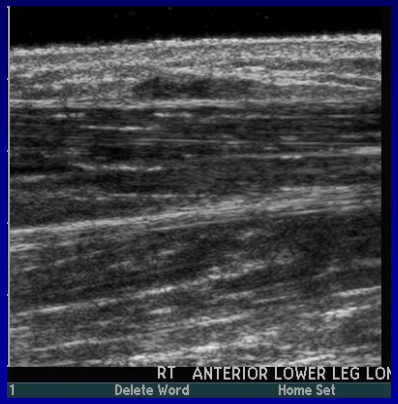


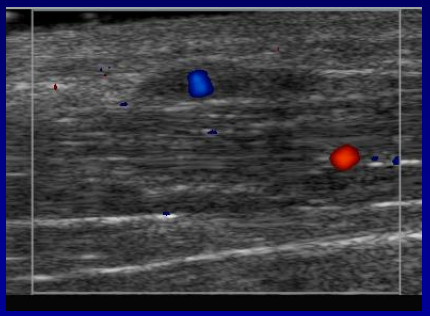
Granuloma Annulare

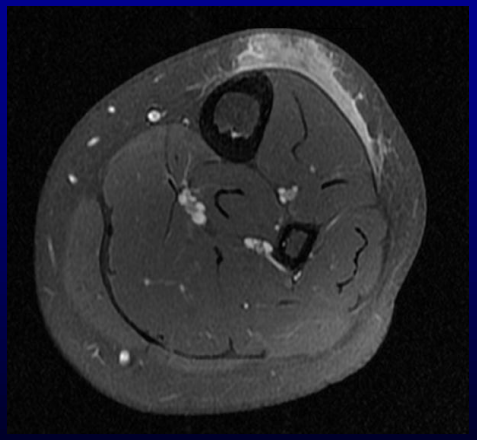
- Asymptomatic
- Benign inflammatory process
- SQ form children
- Peak 2-5 yrs
- Pre-tibial location

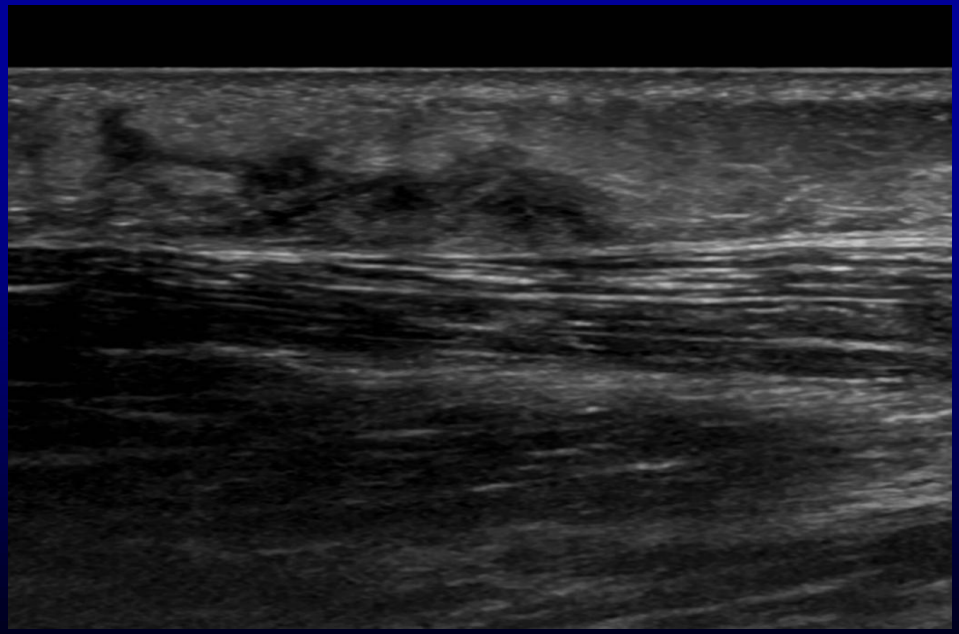
Granuloma Annulare

- Hypoechoic
- Ill-defined or nodular
- SQ tissues
- Vascular

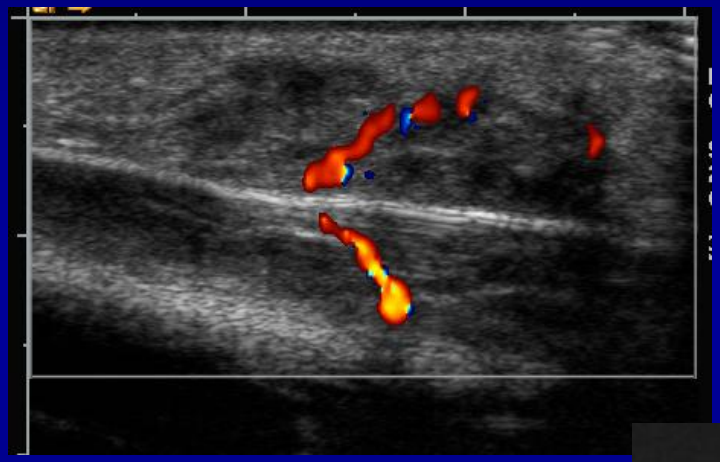


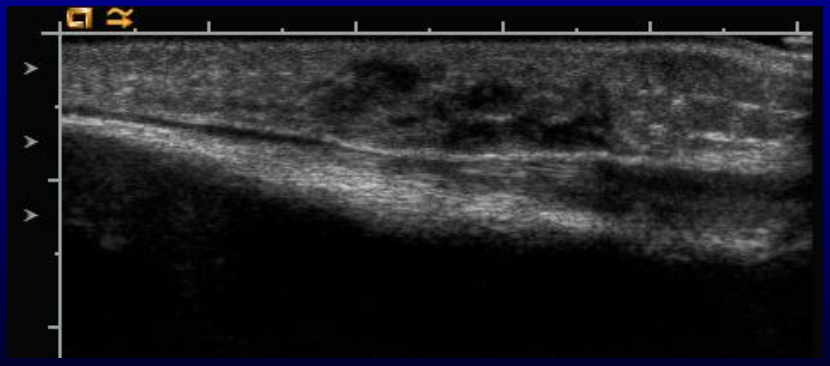


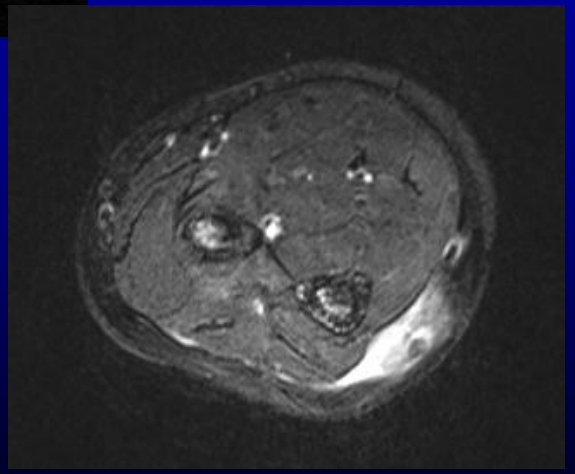




Granuloma Annulare

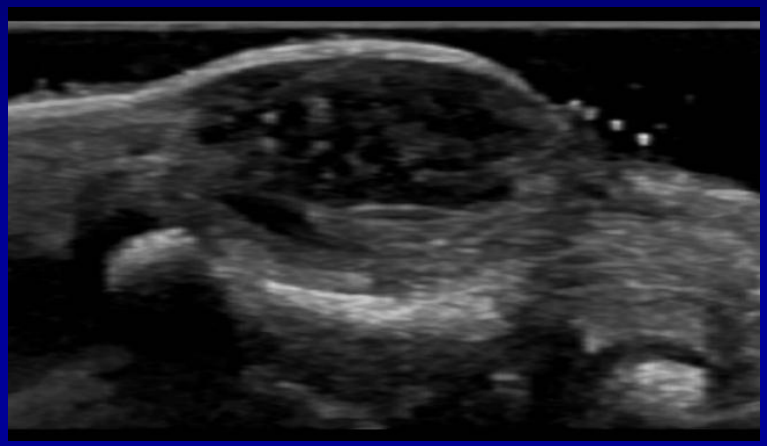


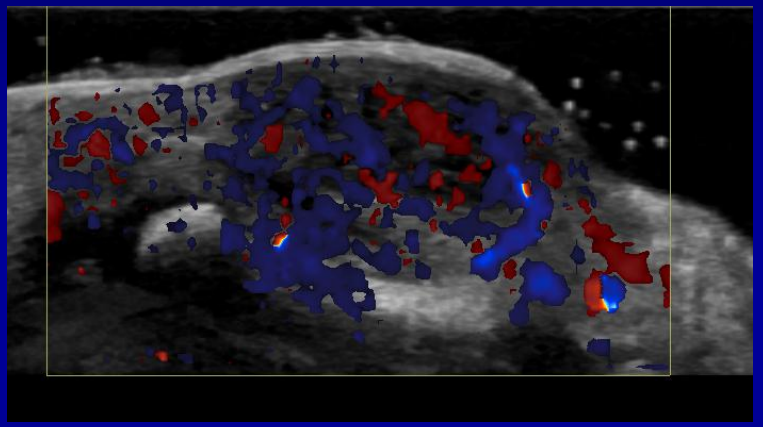




4 yo male, left forearm mass

Granuloma Annulare





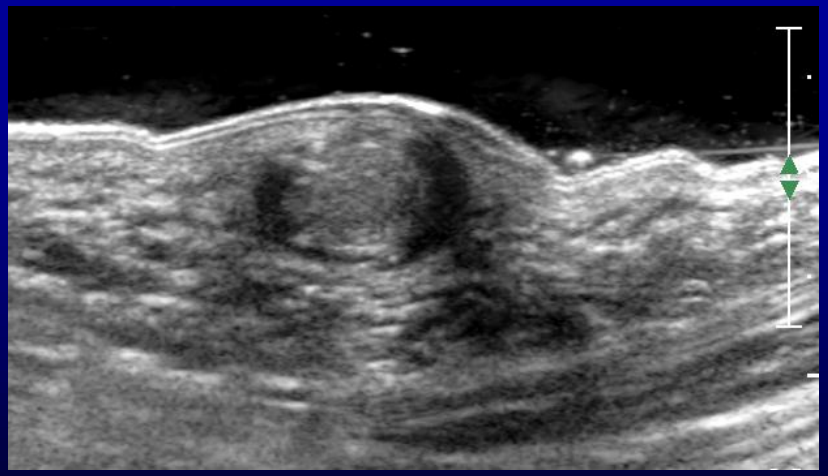
22 mo female,“cysts” on the hands / fingers

8 & 9

- **Epidermal Inclusion Cyst = 4**
- **Herniae = 4**

Epidermal Inclusion Cyst

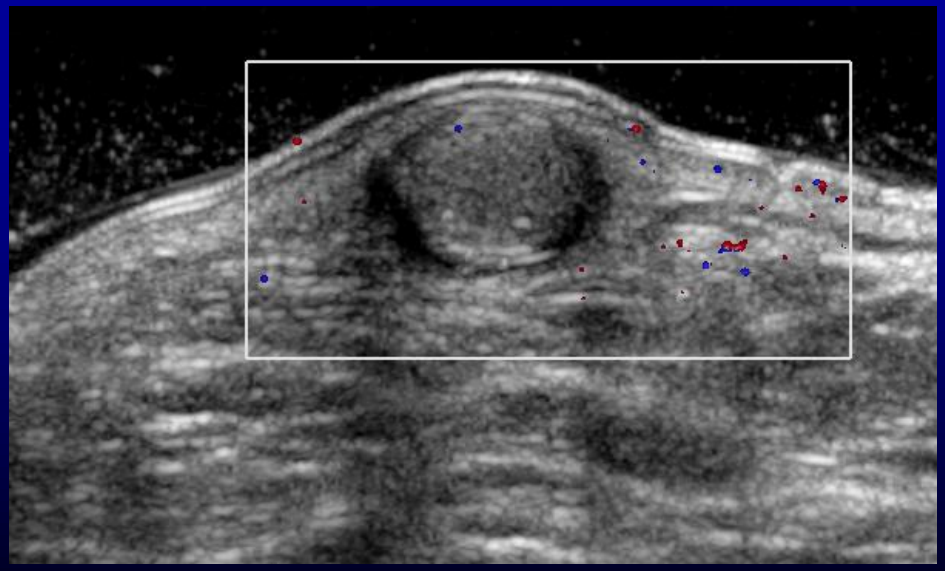
- Most commonly excised SQ cyst
- Dx usually clinical / excisional
- < 10 % occur in extremities
- Keratin



8 year old male with left heel nodule

Epidermal Inclusion Cyst

- Well-circumscribed
- Relatively homogenous internally
- Hypoechoic rim
- No color Doppler flow

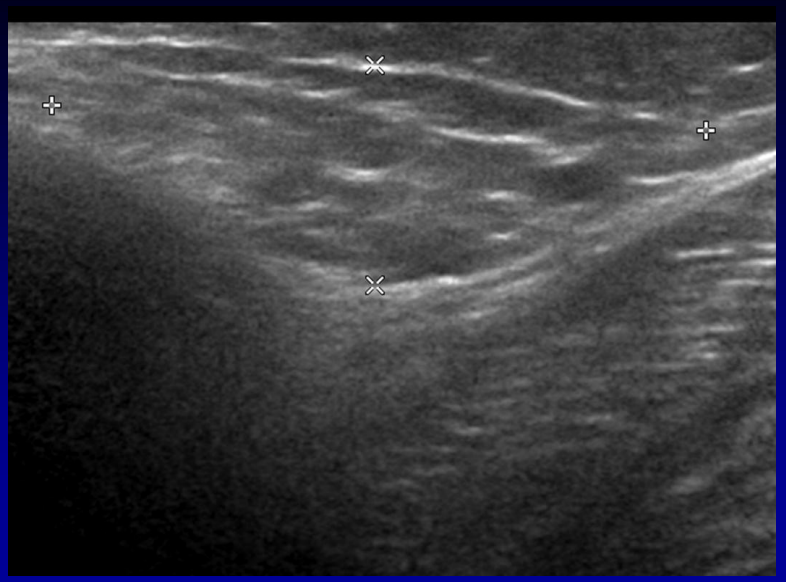


7

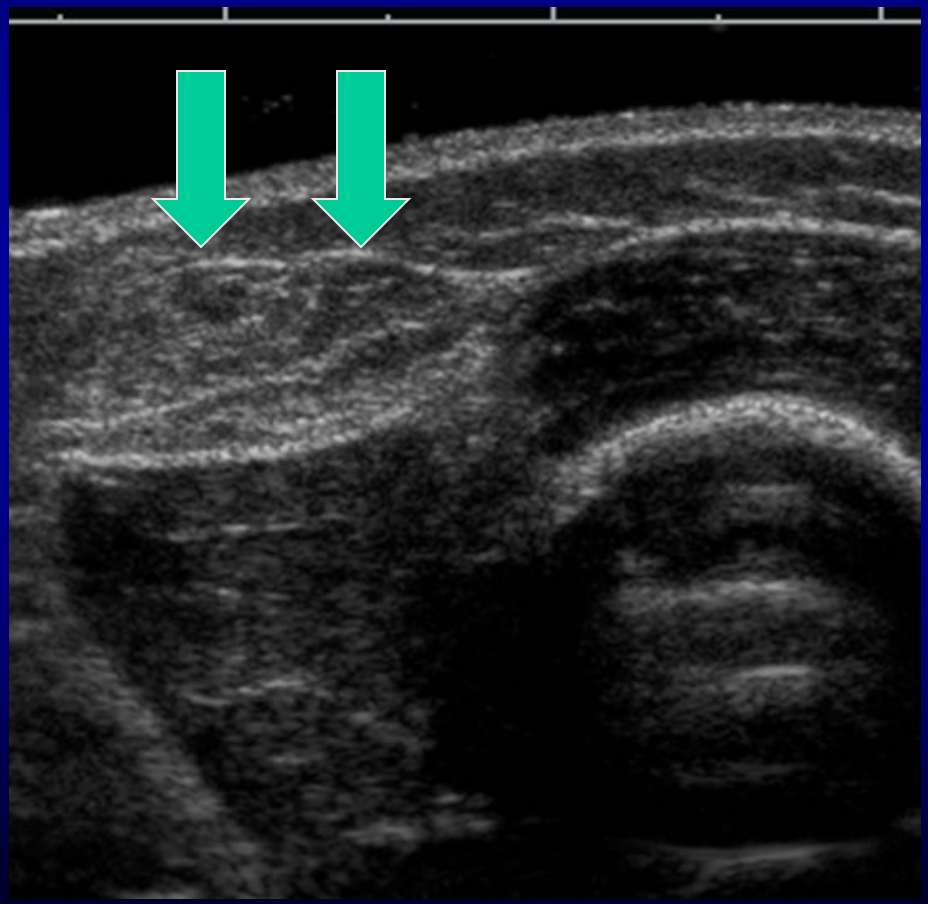
- **Lipoma = 6**

Lipoma

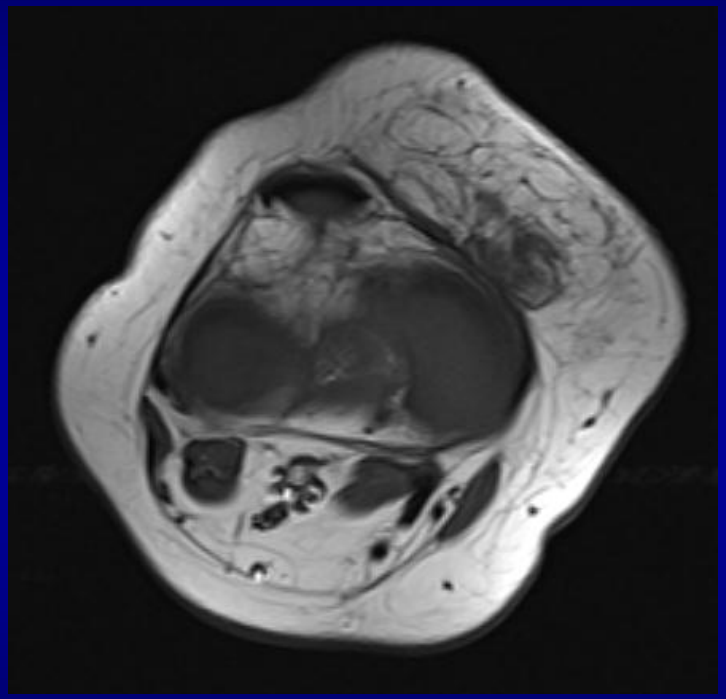
- More common in adults
- 2/3 of adipocytic tumors
- Variable US appearance
  - Hypoechoic to echogenic

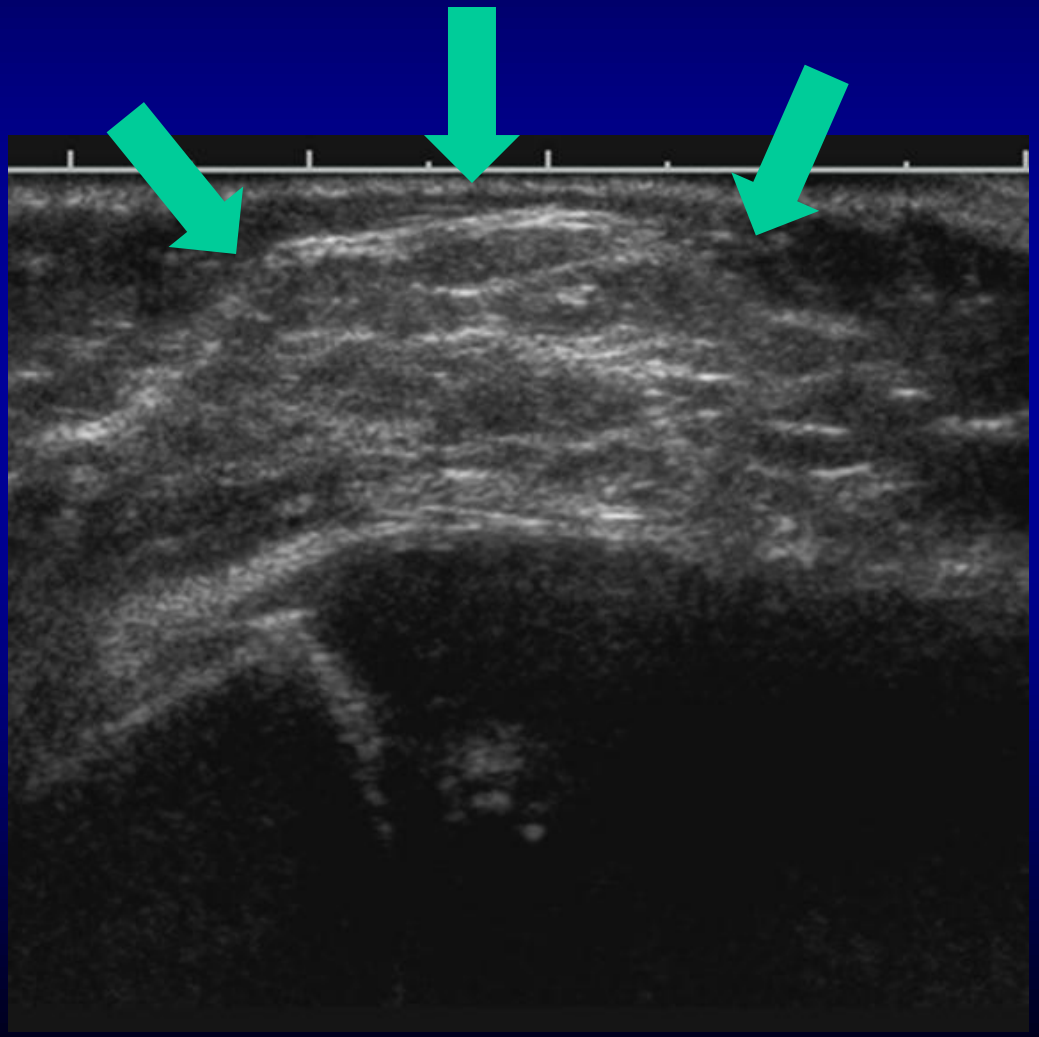


Lipoma



Lipoblastoma





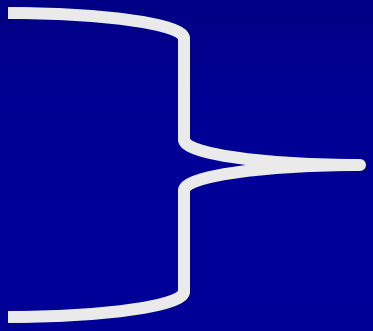
10 month old with
painless knee mass

5 & 6

- **Infection = 13**
  - ***Abscess (6)***
  - ***Cellulitis (5)***
  - ***Phelgmon (2)***
- **Baker's cyst = 13**

Infection

- Cellulitis
- Phlegmon
- Abscess

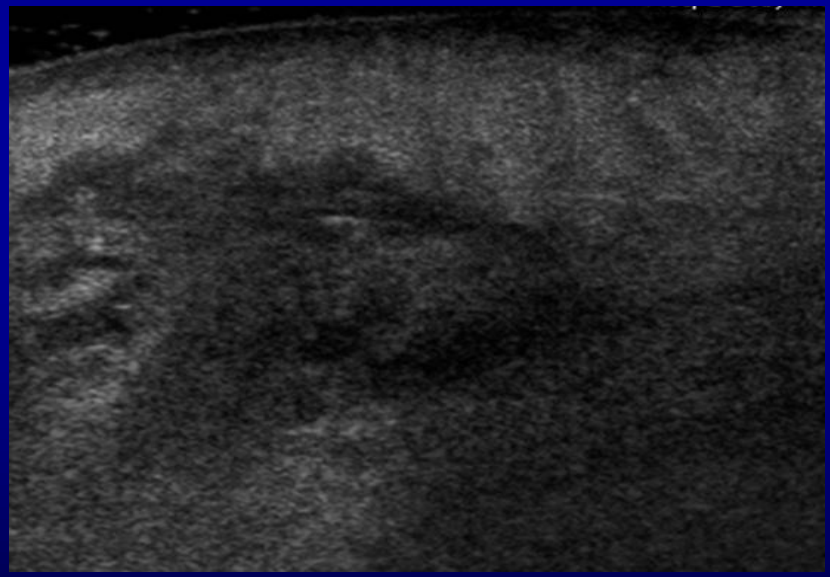


Overlap

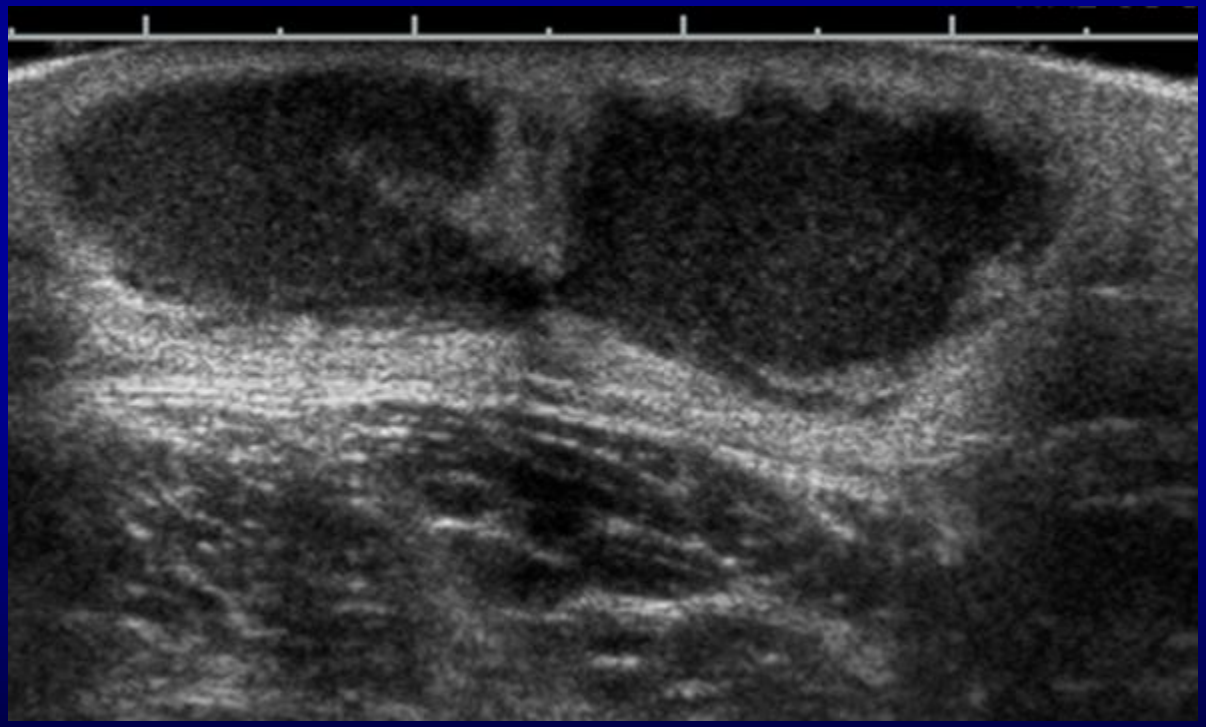
- Exclusion of abscess

Infection

- Sonographic findings mirror the clinical picture
  - Skin thickening
  - Hyperemia
  - SQ edema



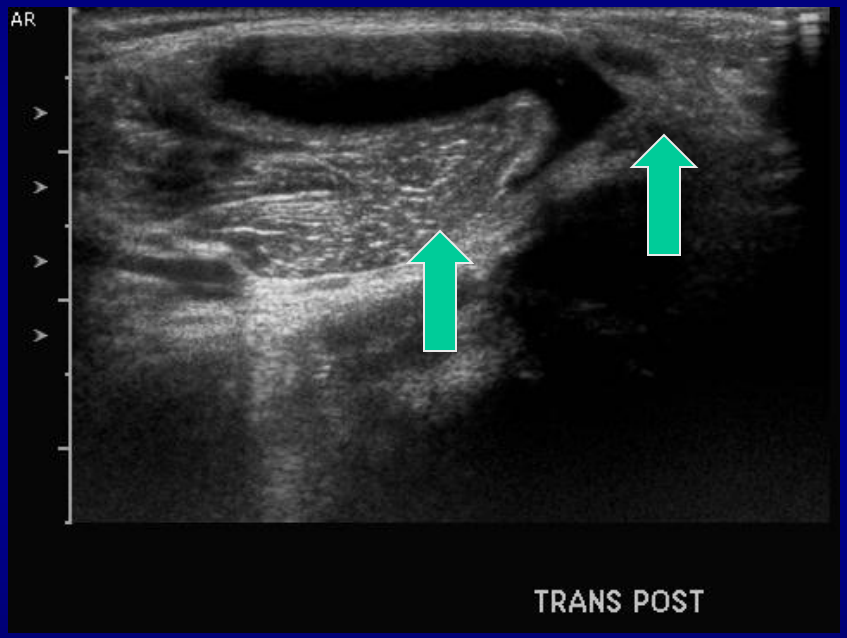
Abscess



7 y.o. female with right thigh mass & fever

Baker's Cyst

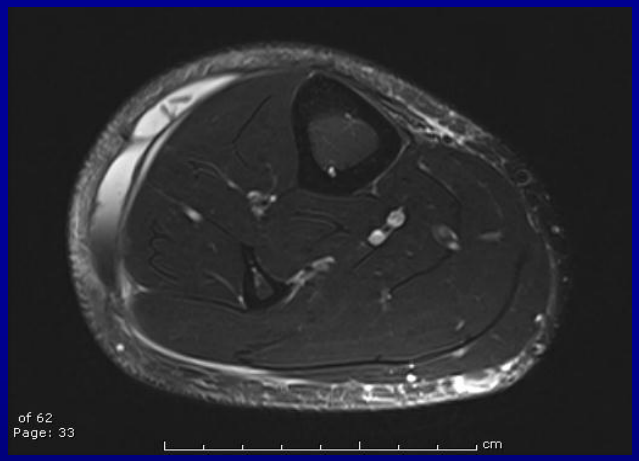
- 2% asymptomatic children
- 6% w knee pain
- Semimemb. & medial head of gastroc. tendons

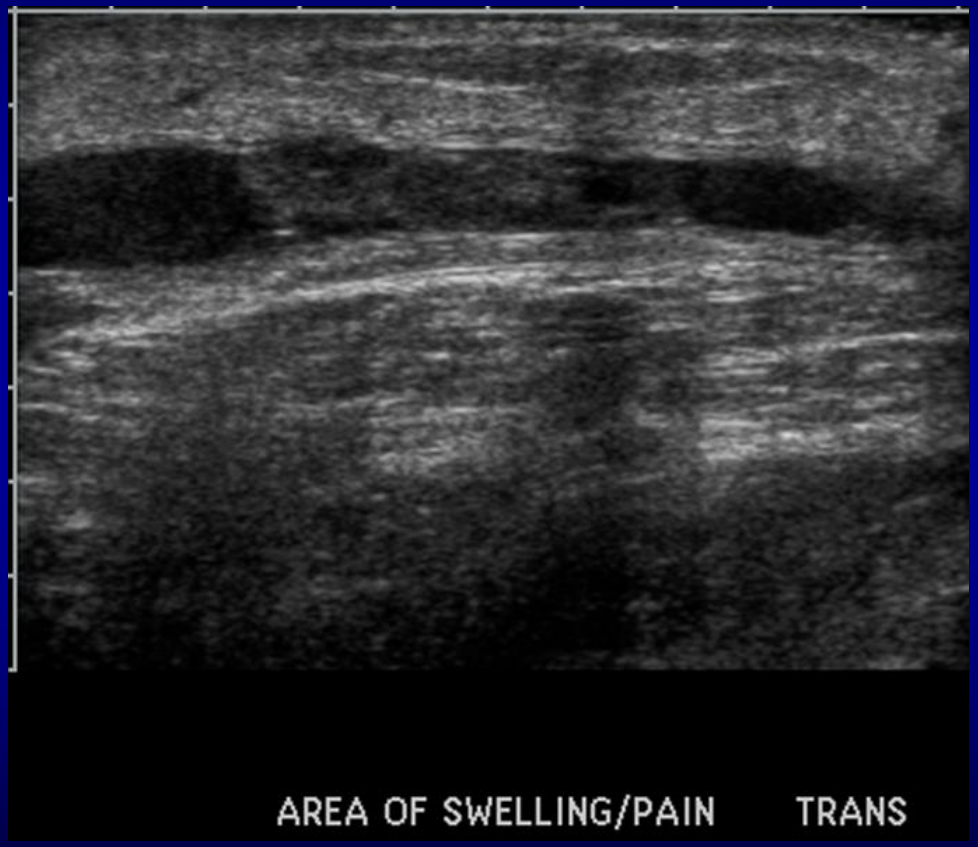


4

- Trauma = 18
  - Hematoma (6)
  - Fat Necrosis (3)
  - SQ injury (4)
  - Muscle injury (2)
  - Muscle Hernia (3)

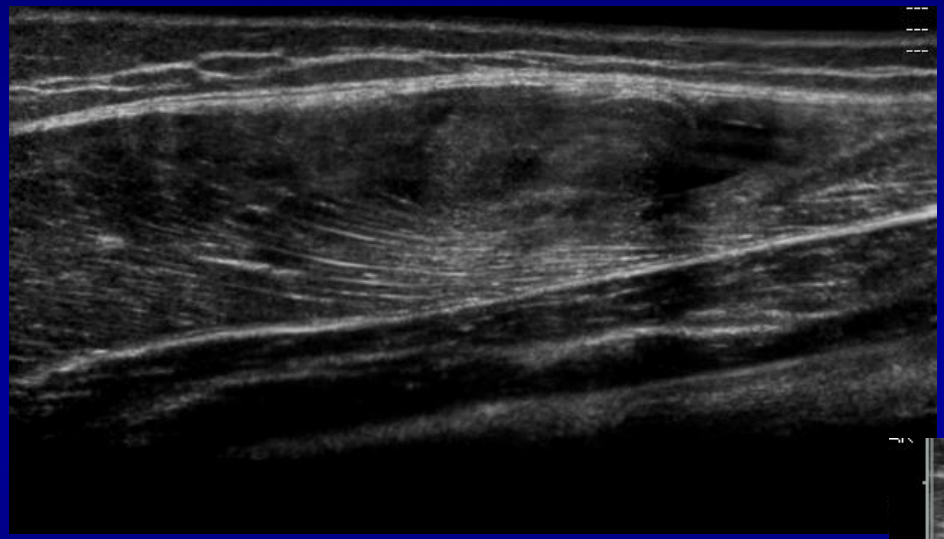
Hematoma

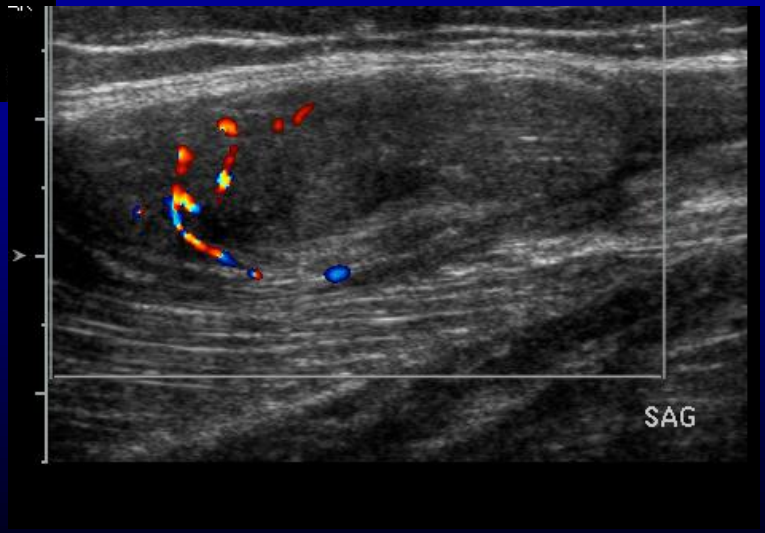




3 y.o. male with leg pain and swelling

Rectus Femoris Strain





2 & 3

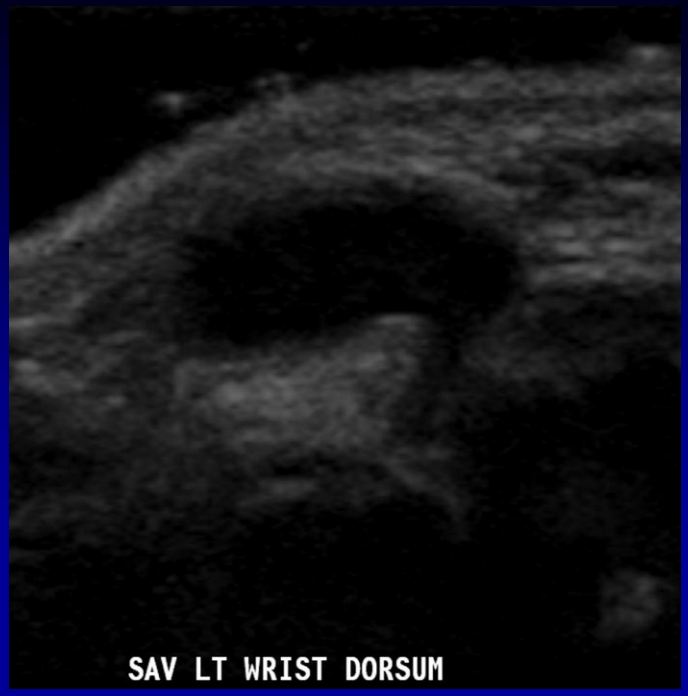
- Ganglion = 19
- LN = 19
  - Normal (9), reactive (4), lymphadenitis (4), dermatopathic (1), Hodgkin's disease (1)

Ganglion Cyst

- Periarticular
- +/- Pain
- 2nd – 4th decades
- Hand / Wrist
- No synovial lining

Ganglion Cyst

- Simple
- Septated
- Tail
- Debris / Solid
- Vascularity



Ganglion Cyst

6 y.o. female w mass near great toe MTP joint

Lymph Nodes

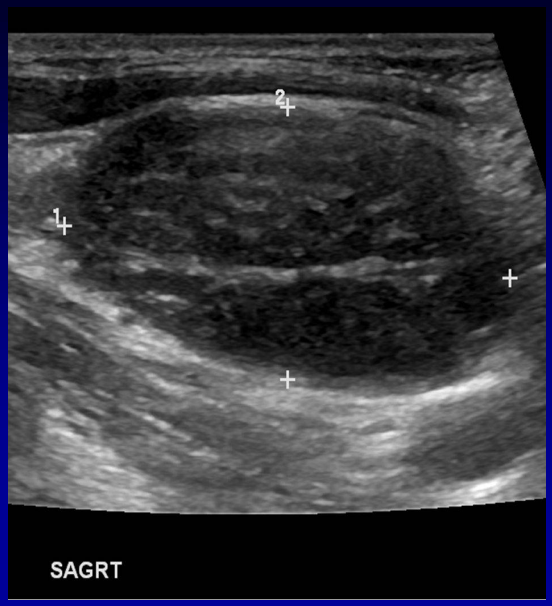
- Very common adults and children
- Vast majority have benign etiology
- Ultrasound often provides reassurance

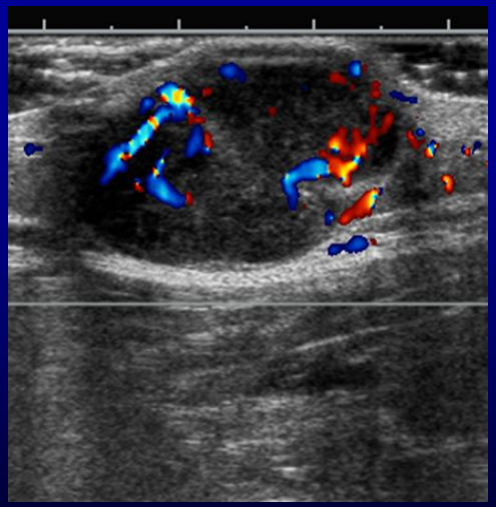
Lymph Nodes

- Benign
  - Oval shape
  - Fatty Hilum
  - Central Vascularity

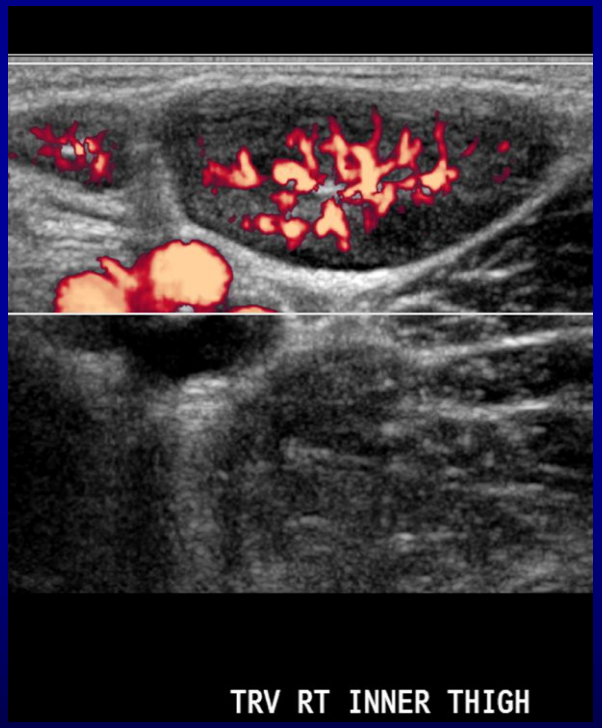
Lymph Nodes

- Malignant
  - Enlargement
  - Round
  - Loss of fatty hilum
  - Heterogeneity
  - Necrosis
  - Peripheral hypervascularity





Reactive Lymphadenopathy



Shape & vascularity can mimic malignancy

1

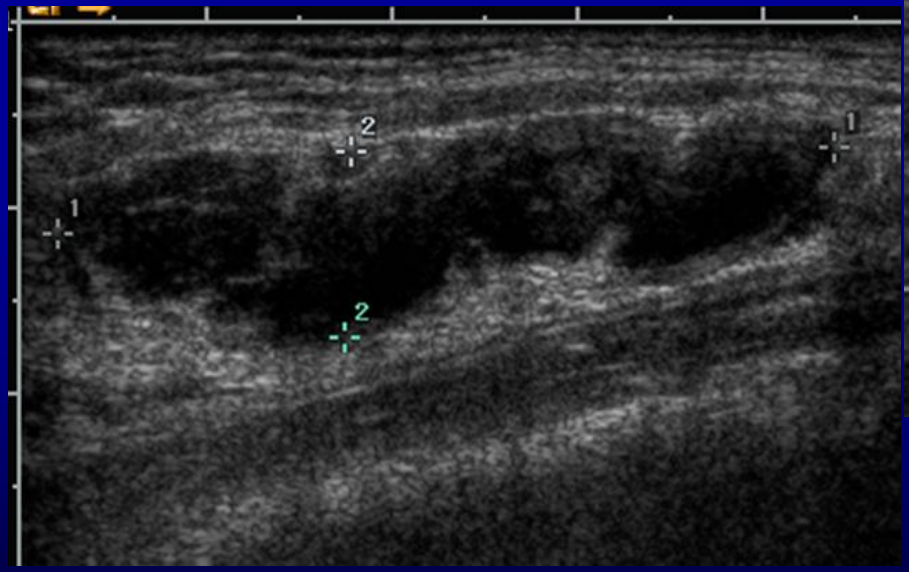
Vascular Anomalies = 36

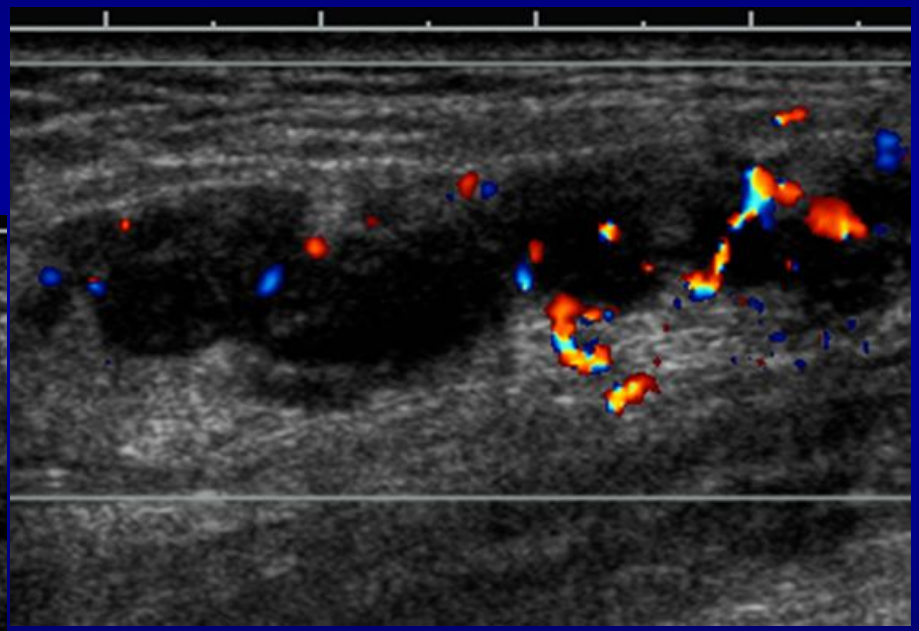
Venous Malformation = 16
Lymphatic Malformation = 9
Infantile Hemangioma = 8
Vascular Lesion NOS = 2
AVM (post traumatic) = 1

Vascular Anomalies

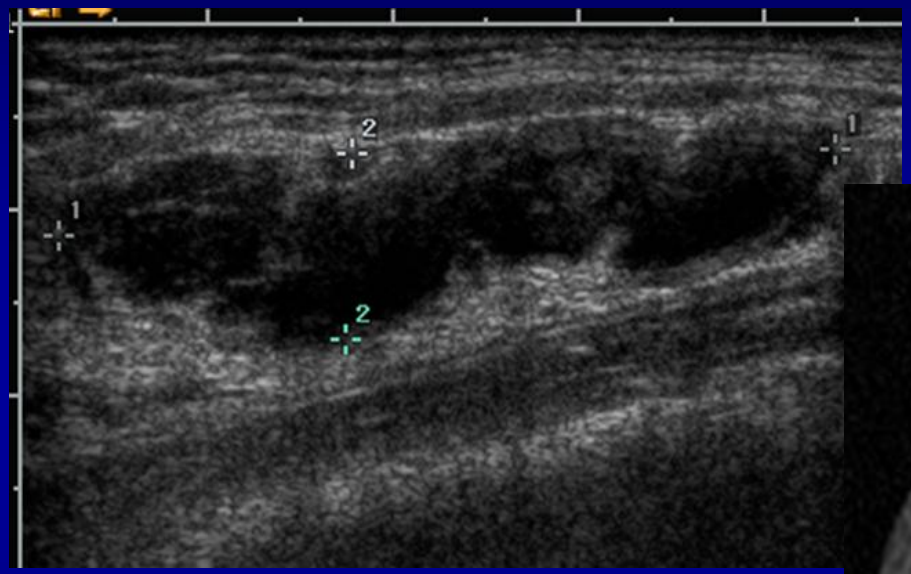
- Vascular Malformations
  - VM
  - LM
  - VLM
  - AVM
- Infantile Hemangioma

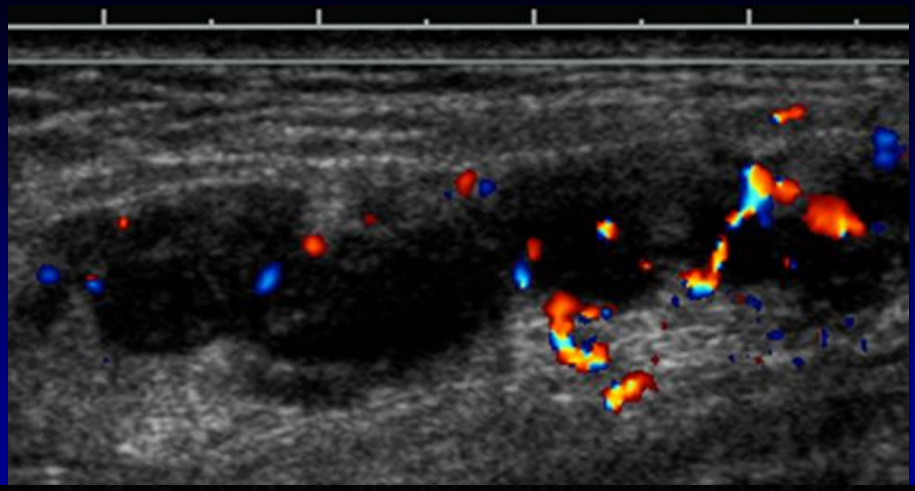
17 year old HIV + girl with arm mass

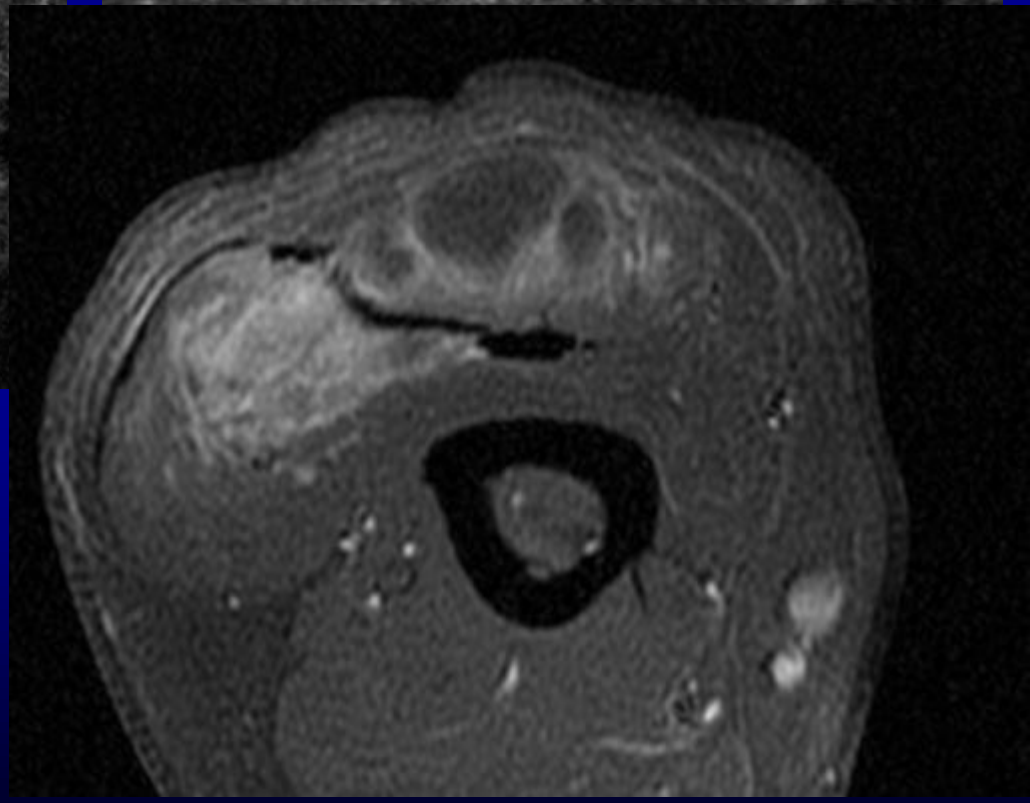




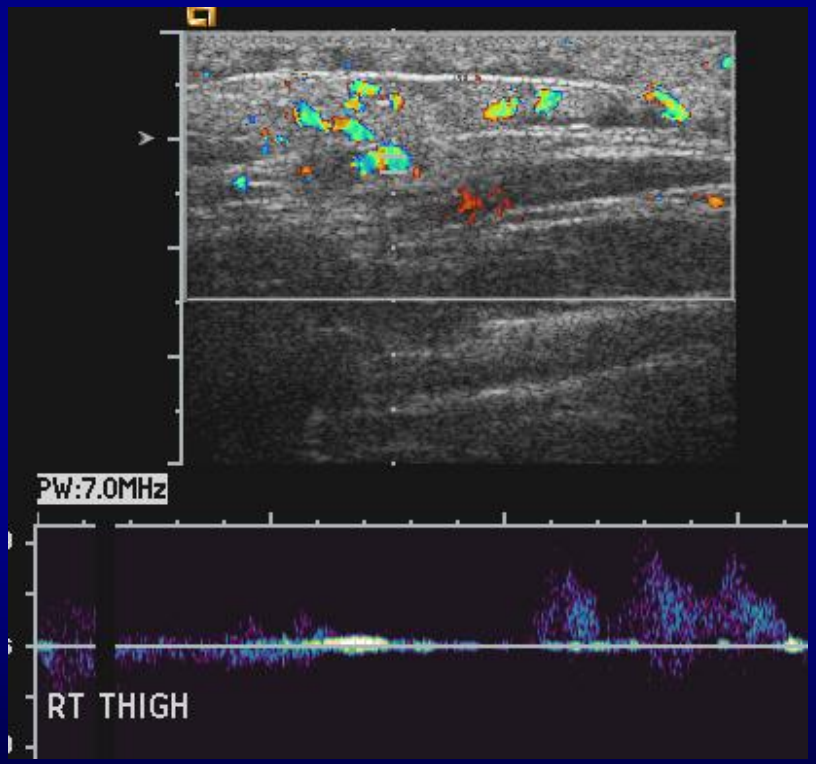
VLM







Infantile hemangioma



3 month old female with thigh mass & cutaneous hemangioma on eyelid

Top Ten List

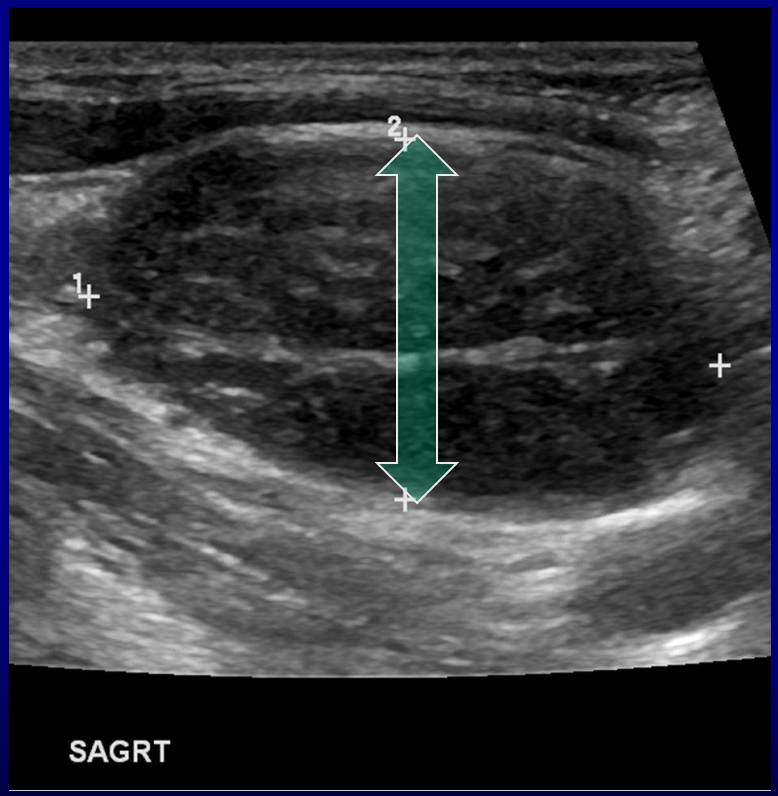
- Vasc malf
- Ganglion
- Lymph nodes
- Trauma
  - Hematoma, Fat necrosis
- Baker's cyst
- Infection
- Lipoma
- Hernia
- Epidermal Inc Cyst
- Misc
  - Pilomatricoma, GCell Tumor TS, Foreign Body, Granuloma Annulare, Axillary Breast Tissue

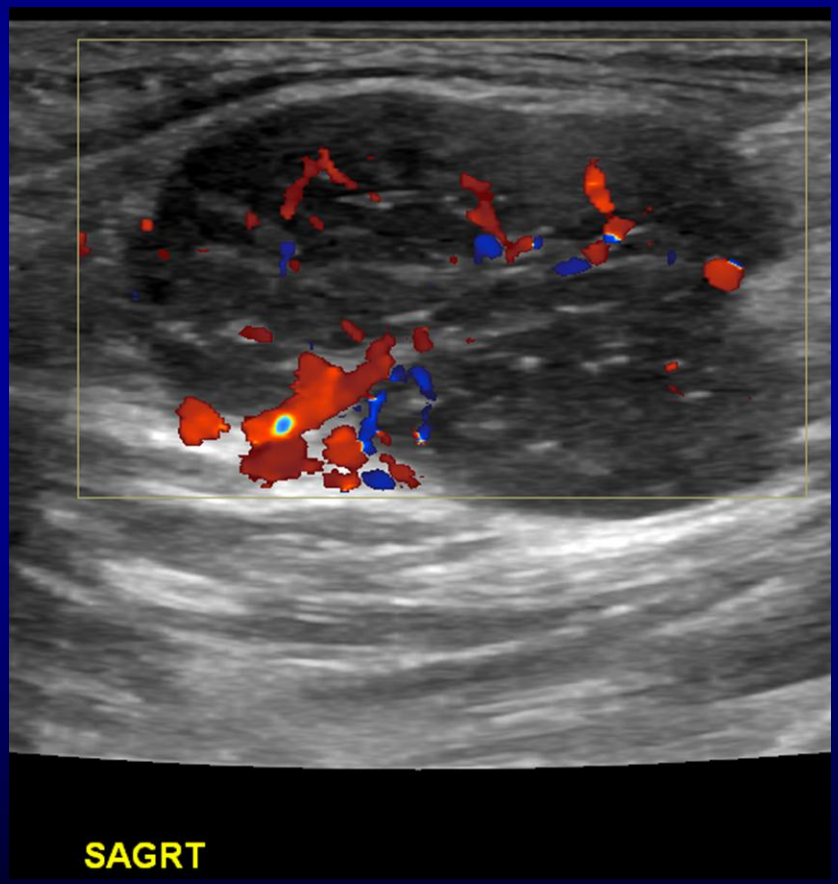
Malignancy

Malignancy

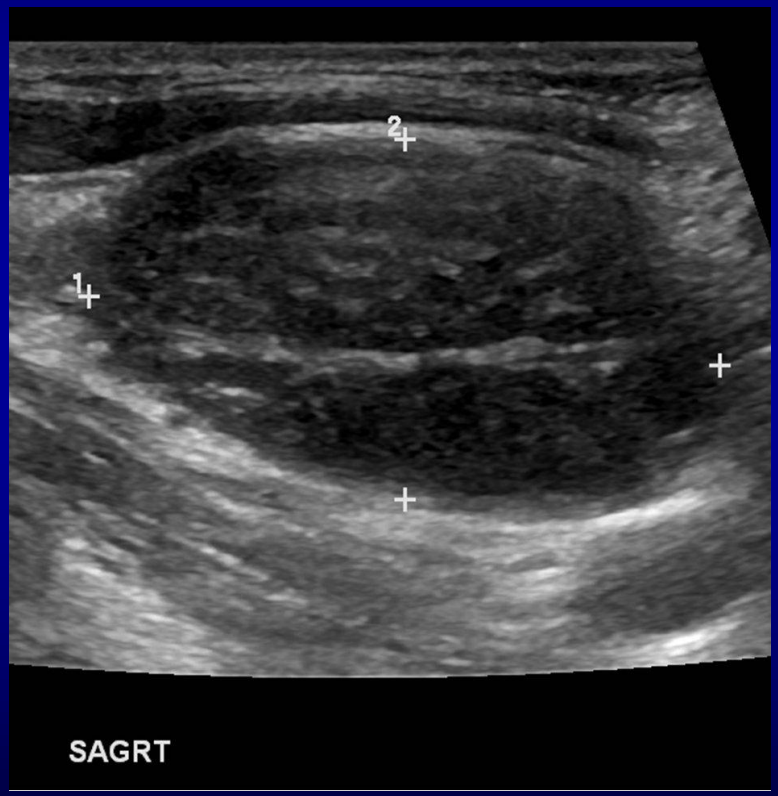
- > 5 cm
- Pain
- Increase in size and depth beneath the deep fascia
- Significant displacement of surrounding tissues

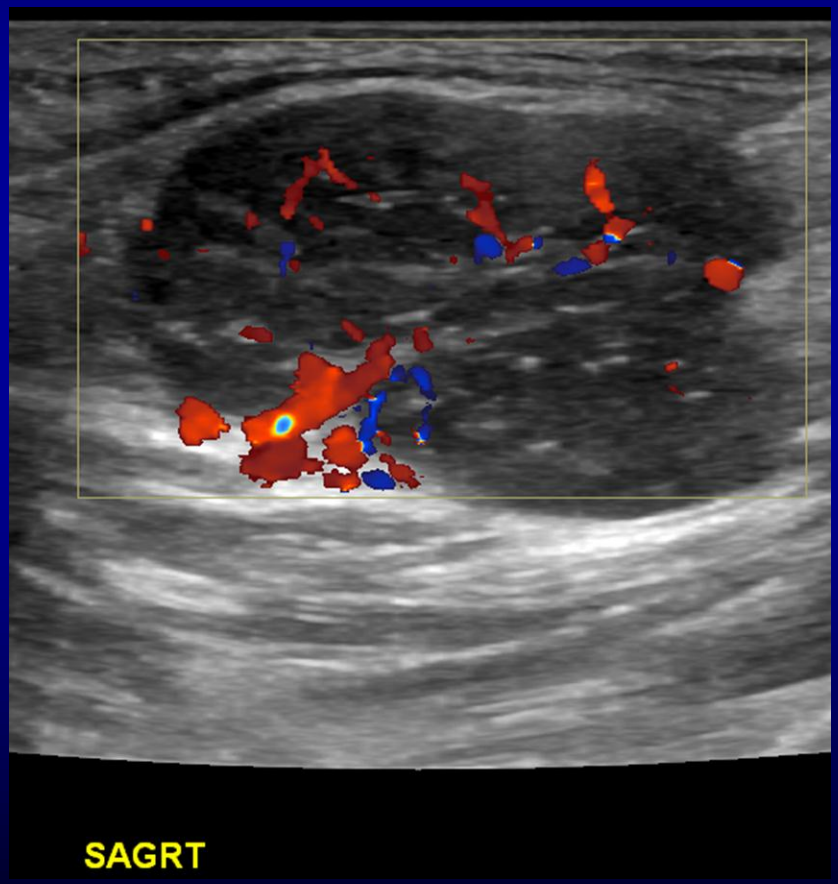
14 y.o. girl w/ palpable lymphadenopathy



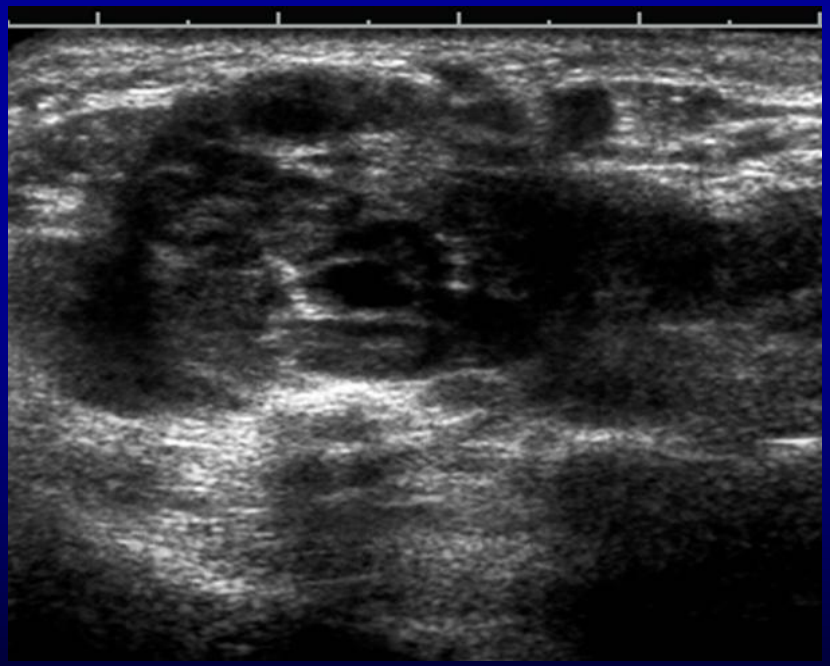


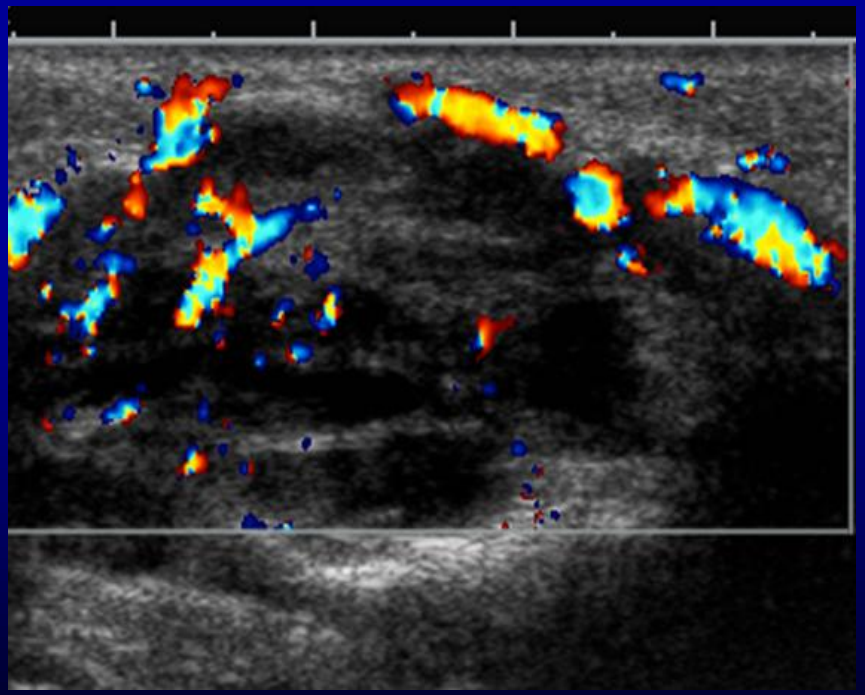
Nodular Sclerosing Hodgkin's Disease



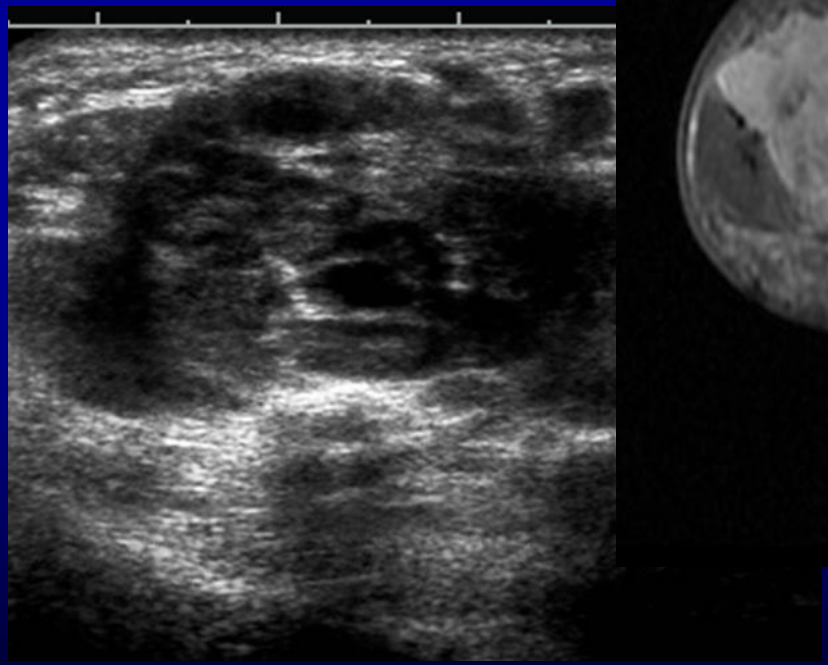


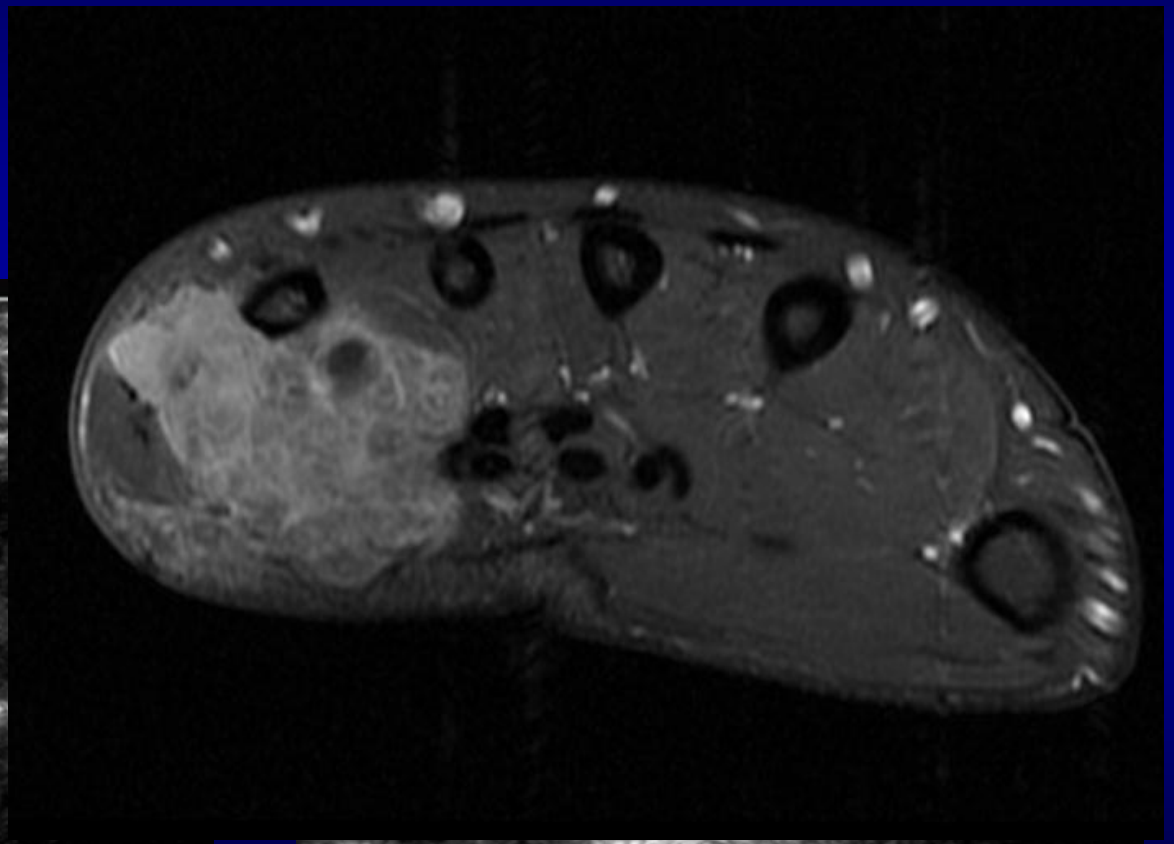
16 year old girl with painless palmar mass



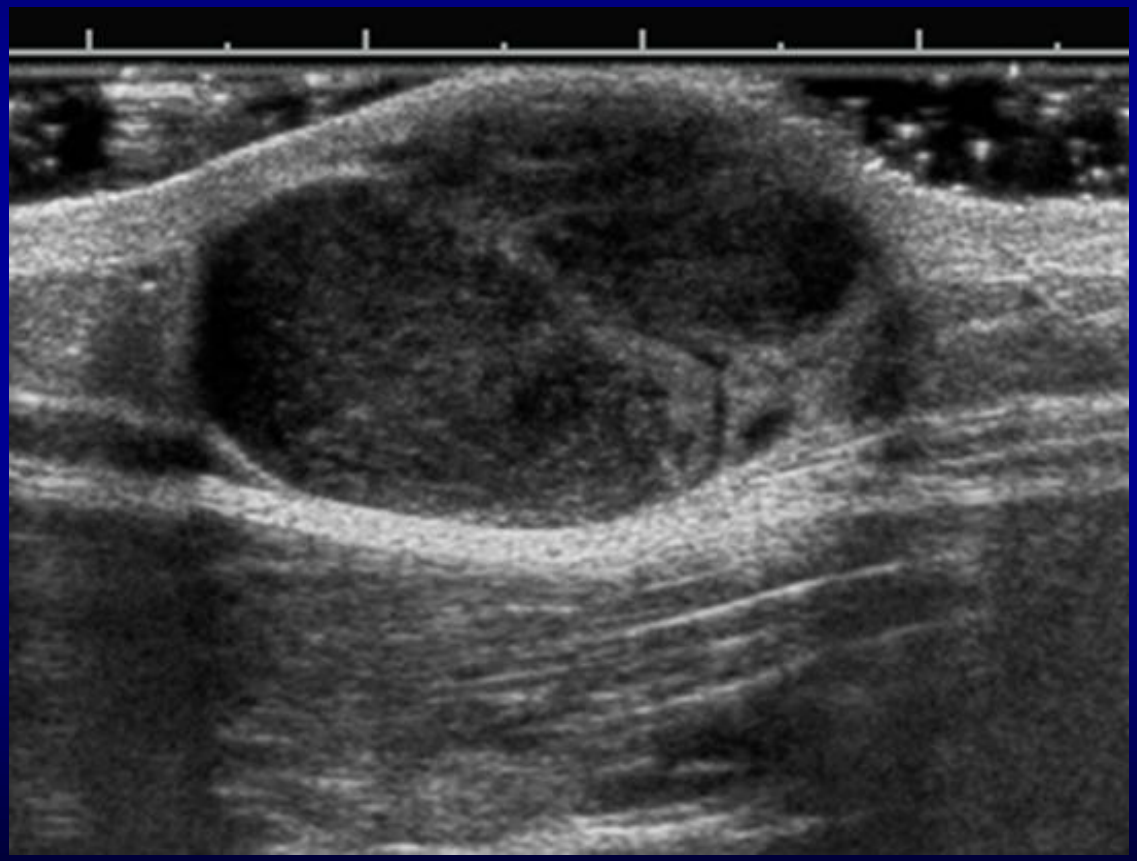


Rhabdomyosarcoma

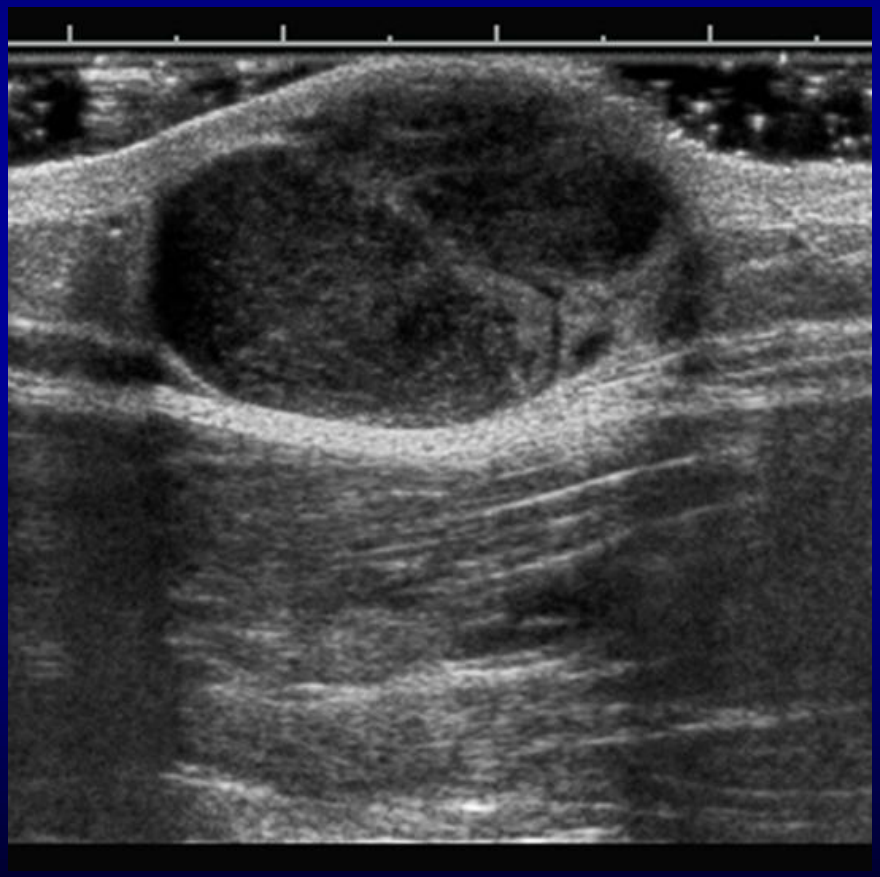


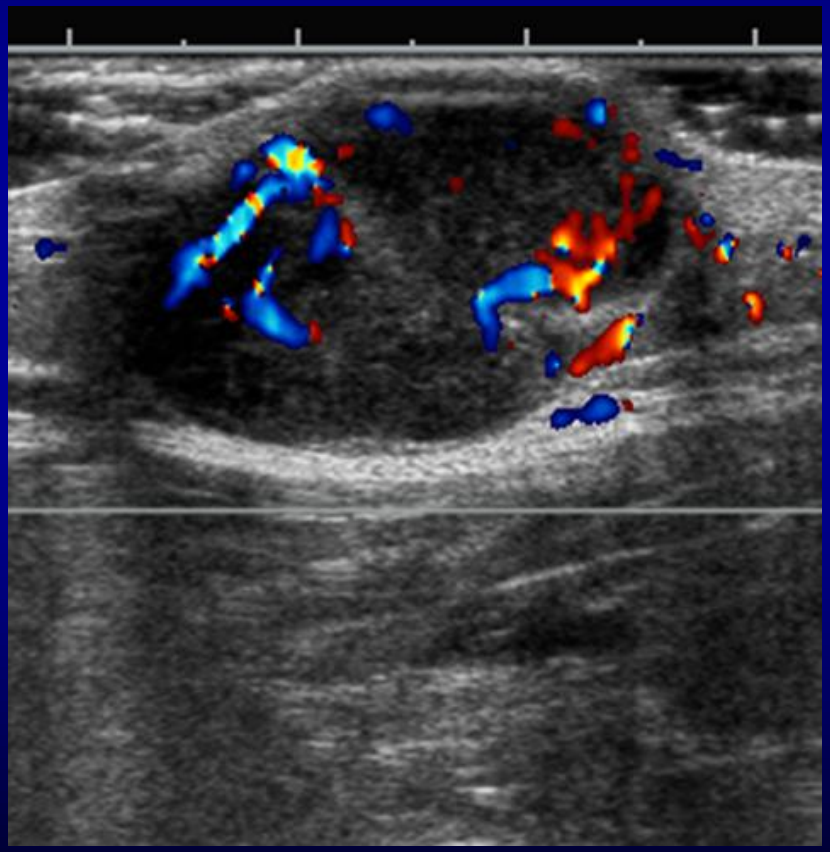


17 y.o. male, enlarging thigh mass

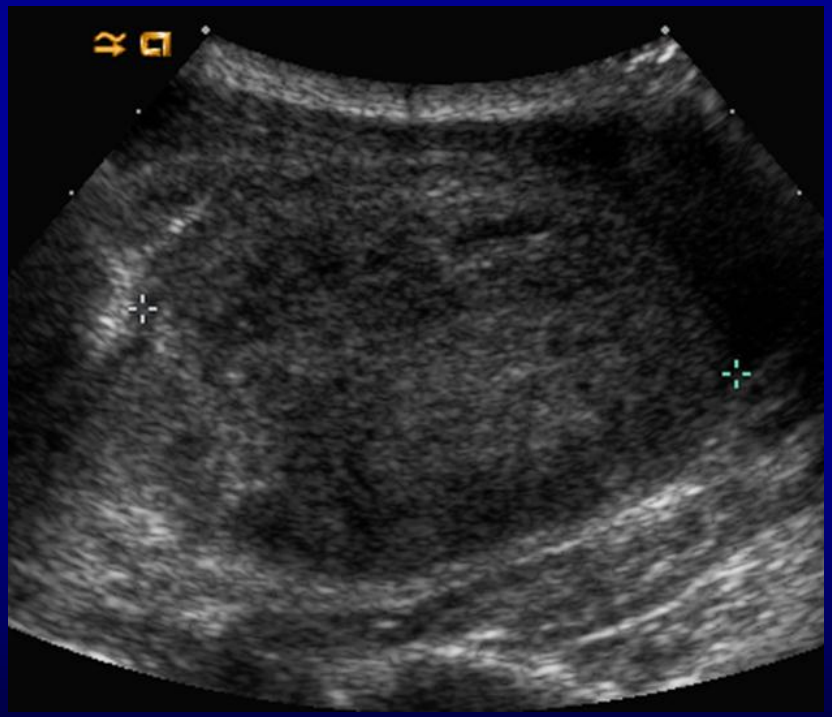


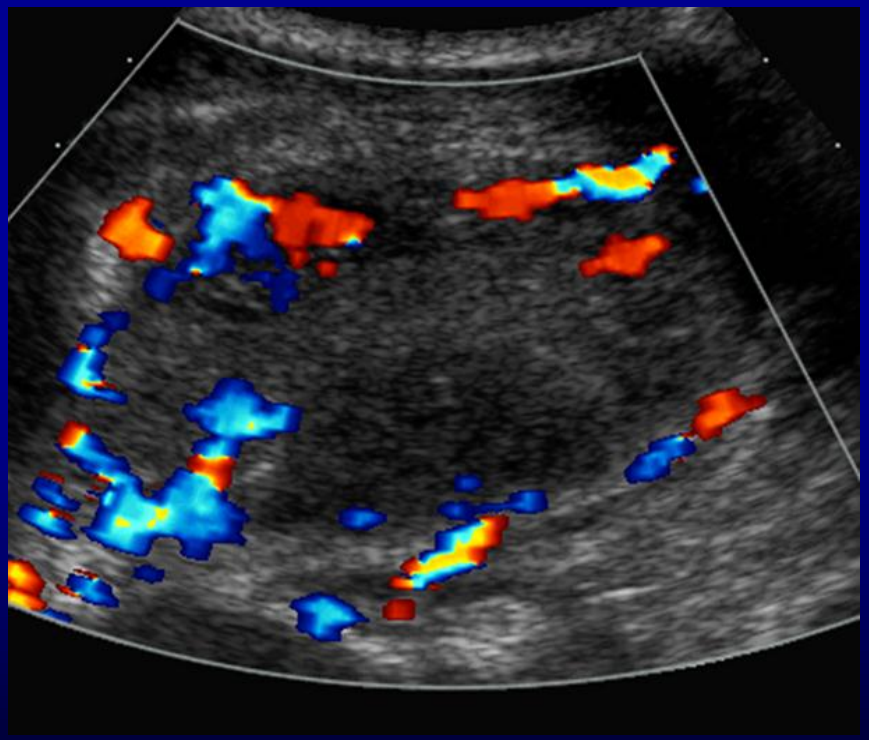
Dermatofibrosarcoma protuberans



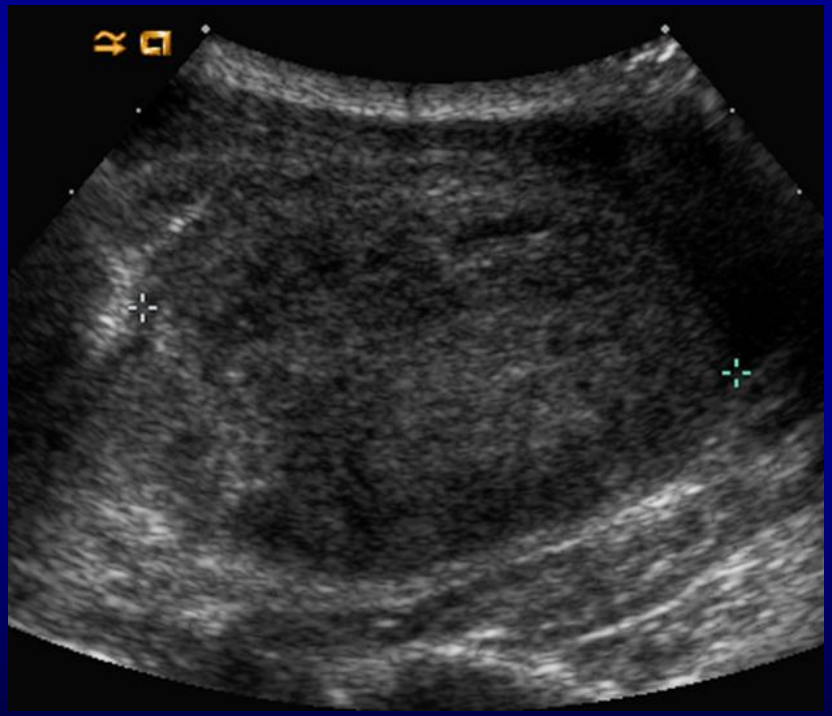


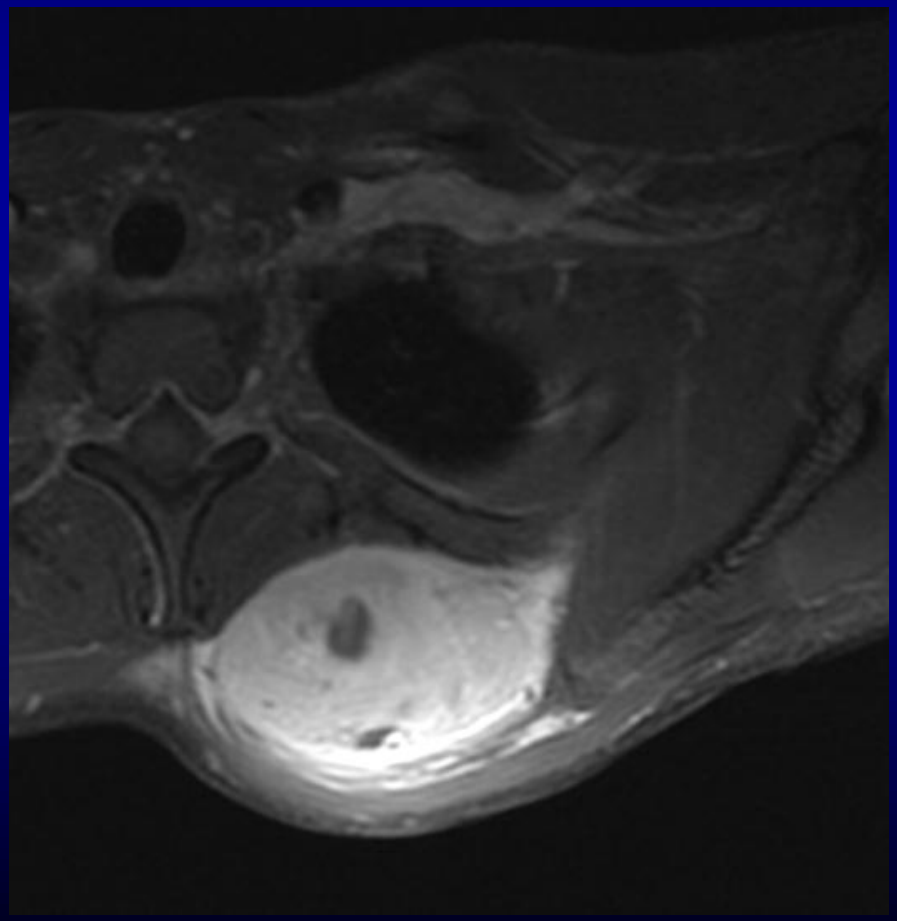
17 y.o. male, new left shoulder mass



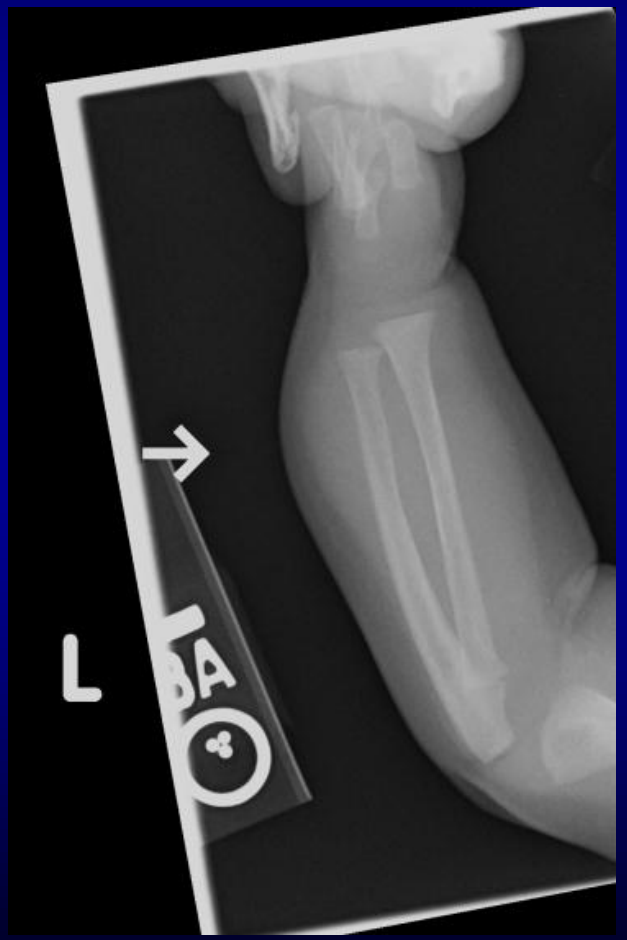


Malignant peripheral nerve sheath tumor

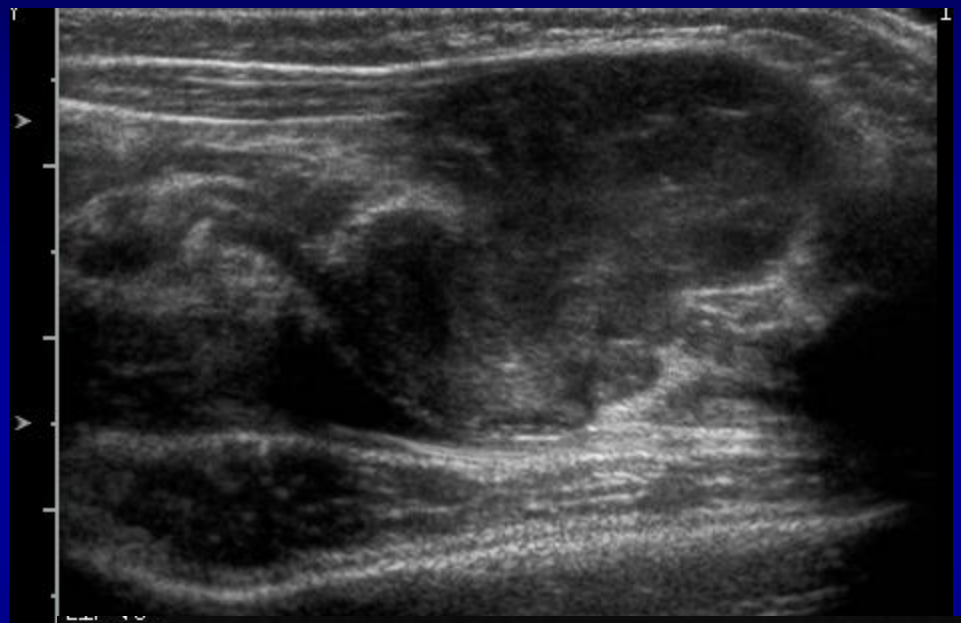


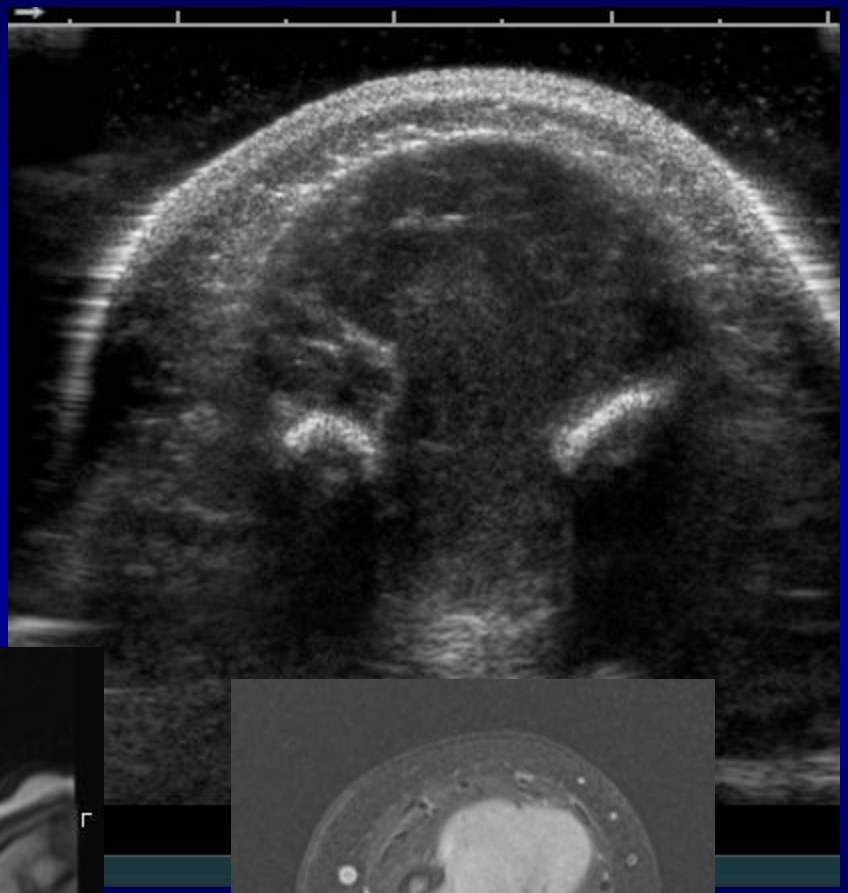


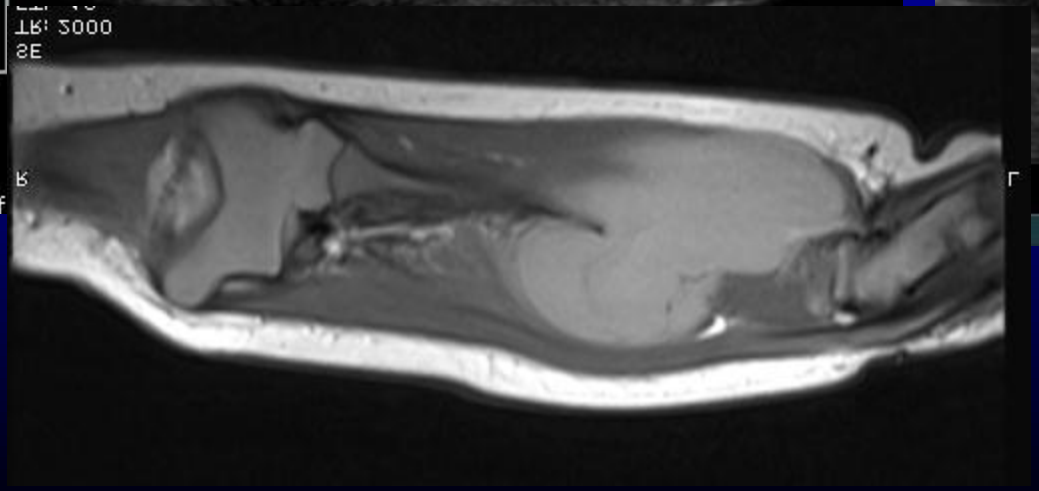
2 mo female with enlarging forearm mass

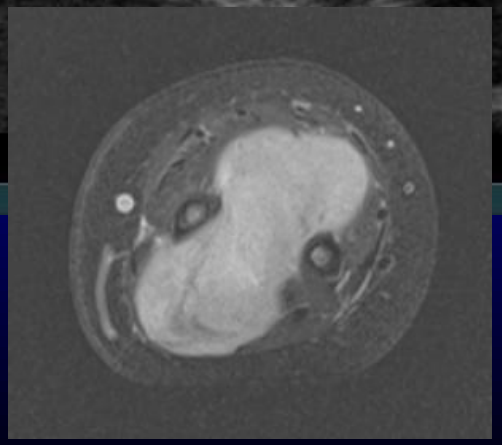


Undifferentiated Sarcoma









Learning Objectives

- Background information
- BCH experiences
- Clinical perspectives

Surgical perspective

- Imaging may be avoided
  - Pilomatricoma
  - Cutaneous infantile hemangioma
  - Subcutaneous infection
  - Post traumatic hematoma

Surgical perspective

- Imaging should be performed if biopsy or surgical procedure is planned

Lesion Characteristics

- Cystic components
  - Pure cysts nearly pathognomonic of benign lesions (cyst, hematoma, abscess, LM)
  - Some malignant tumors can have cystic components (necrosis)

Lesion Characteristics

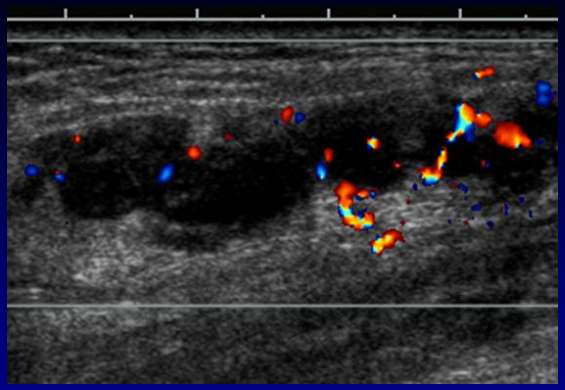
- Fat
  - Fatty component suggests a benign lesion (lipoblastoma, fibrolipomatous hamartoma, lipoma, dermoid cyst)

Lesion Characteristics

- Vacularity
  - Poor predictor benign vs. malignant
  - Complete absence of vascular flow indicates benignity

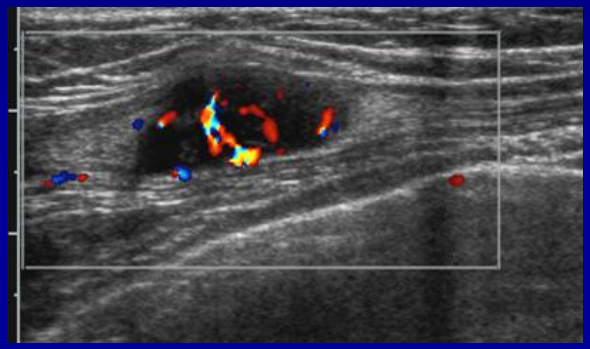
Pitfalls

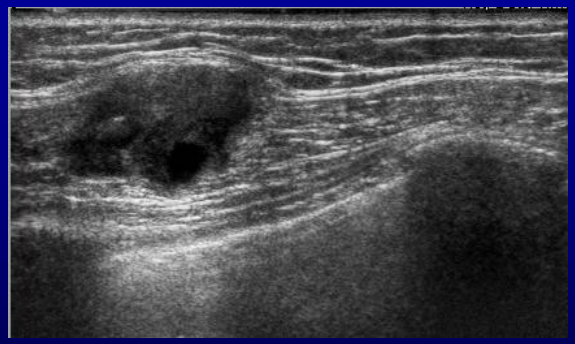
< 5 cm



HIV +

Past Med History





Spindle Cell CA

Vascular Lesions

Reactive Lymphadenopathy

Objectives of Imaging

- Primary objectives:
  - Confirm solid mass
  - Define precise location and characteristics
  - Guide the decision of whether to perform biopsy, excise or observe

Objectives of Imaging

- **Know your limitations:**
  - **Frequently ultrasound cannot determine the exact nature of a soft tissue lesion**

Further imaging

- MRI
  - Superior contrast resolution
  - Deep extent of lesion

Absence of definite signs of benignity

- Short term f/u
- MRI
- Biopsy

Ultrasound Evaluation of Lumps, Bumps and Small Parts of the Extremities

Michael J. Callahan, M.D.
Department of Radiology
Boston Children's Hospital